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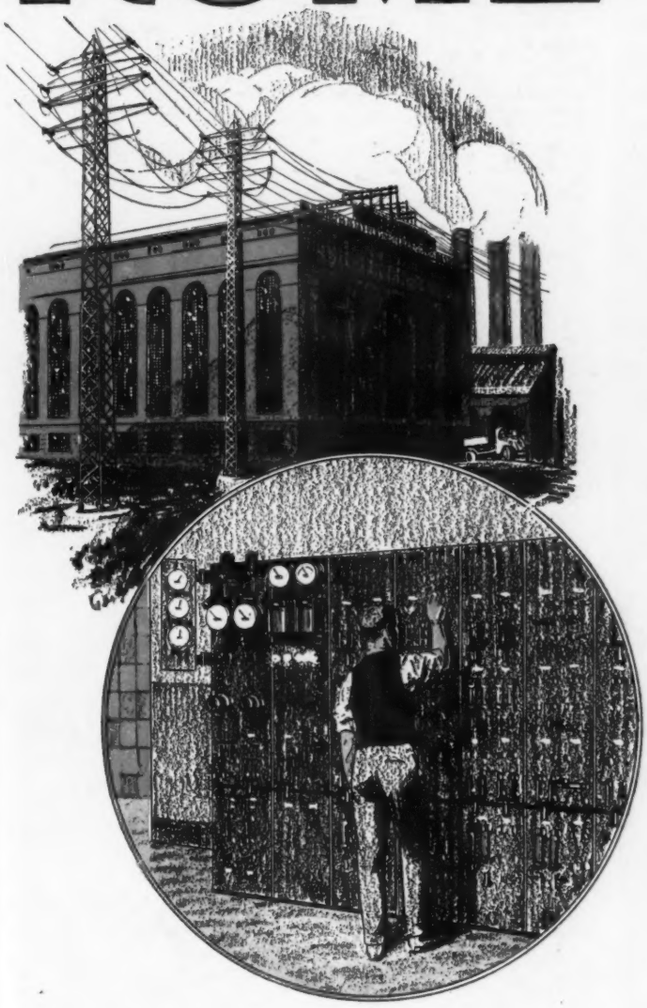

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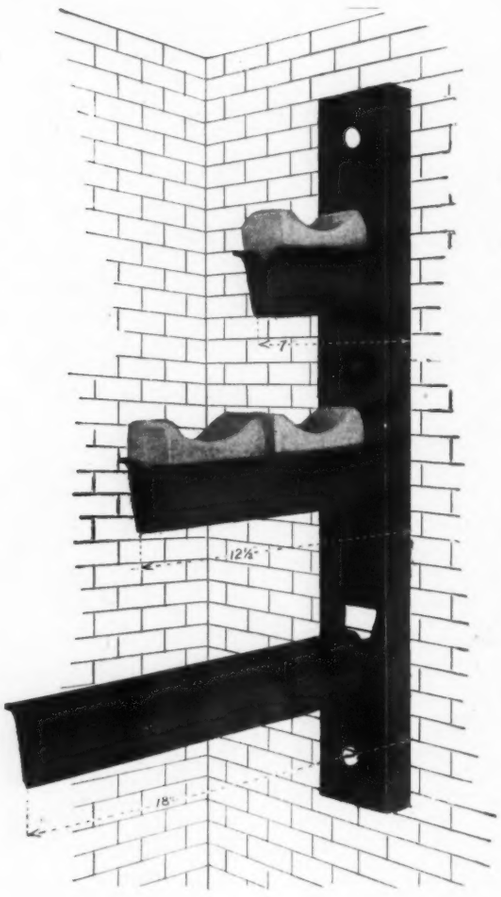

Bulletin 9 tells the Story

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New Plans for the Society for Electrical Development

IT IS a very significant and interesting thing that the board of directors of the Society for Electrical Development has adopted a new policy of expansion and broader service. These men are acknowledged leaders in the four branches of the industry. Their judgment is good; their word is good. Therefore, when they say that the society is to be reorganized under the leadership of William L. Goodwin and to go ahead to achieve the broad aims with which it was originally conceived we can believe it and be glad. The society unquestionably has the opportunity to be of great usefulness to electrical men of every class. Mr. Goodwin's well-proved genius both as an educator and a man who gets things done gives promise that the work will be carried through with breadth of vision and with clarity of purpose. The definite plans which are outlined in this issue show that the broader economic function of the society is to be emphasized and expanded, and such service will be of direct aid and benefit to every city. The society brings to Mr. Goodwin a machinery for vastly strengthening the influence of the great work which he has been doing to build up better business methods and encourage a broader vision in the inter-relations of the electrical industry. Mr. Goodwin brings to the society a quality of leadership that will stimulate the interest and strengthen the support of a greatly increased and vitalized membership. It is a fortunate and a very practical combination that should be productive of real, tangible progress.

Edison's Test of Education

BY THE criticisms of the long list of questions compiled by Thomas A. Edison as a test of the eligibility of applicants for positions in his East Orange works a wide diversity of opinion as to what a college graduate should know has been divulged. If it was the purpose of Mr. Edison to test the efficiency of the college curriculum, we cannot indorse the method he employed. If, on the other hand, he aimed to test the kind and extent of the applicant's reading, his power of observation and the retaining power of his memory, the test is sufficiently comprehensive to be fair. From this standpoint it would effectively reveal a disposition to "bluff" and make wild guesses as compared with a disposition to be specific and accurate in expressing facts and ideas. Aside from these viewpoints, Mr. Edison's questions have definitely raised the question, What is education? We agree with the comment of one critic that frequently the college graduate believes his diploma is a certified check on the bank of wisdom, while in fact it is simply an invitation to open an account. For this class of men Mr. Edison's questions have provided an effective means of introspection that can be used by non-college men as well as by those who have earned a college degree. If the result has induced the purchase and a new study of the dictionary, the encyclopedia and works of history, a great good has been accomplished. It is a good thing to take stock of our ready knowledge from time to time, and if Mr. Edison has furnished the incentive, his great genius should receive another credit mark. When a realization is brought about of the importance of looking thoughtfully at life and its practical problems, of mentally cataloguing information for ready reference and of regularly adding to the storehouse of knowledge as periodical inspections and experience show a lack of it, then and only then can any one lay claim to education, whether he be a college man or one who has been less fortunate.

Need for Executive-Engineer-Banker in the Industry

FINANCIAL problems which have harried the electric light and power industry for the past decade indicate that we need something besides a knowledge of electricity in this business if it is to be a success. We lack a friend at court in the person of a banker who combines with a knowledge of banking an intimate knowledge of the electric light and power business and its possibilities. Had we possessed a few men of that type in our great national banking institutions, some of our problems would have been a trifle easier; for when we have to pour our story into ears not attuned to electricity and appeal to hearts of flint for the wherewithal to expand the business, not only is the task made much harder in degree but the actual results fall far short of the necessity. Moreover, in dealing with city officials or with the public the word of such a banker is of much avail. Imagine a utility in Podunk in need of funds. It applies to a well-known national bank for a secured loan. The executive-engineer-banker visits the city and, let us say, finds the proposition worthy from all points of view. He makes known to the Mayor of Podunk that his bank, known by name in every home in the land, is considering loaning the Podunk Electric Company one million dollars to be expended for additions and betterments. "Will the company get a fair deal?" he asks the city fathers, for under no other circumstance would his bank be willing to advance the money. The answer, if the utility is deserving at all, is certain. This is but one angle. Now, the utility business is important enough and its financial requirements are large enough to warrant some of our great banks having on their executive staffs specialists versed in our business. With men who can reason understandingly about public utilities and the necessity of sound financing in connection with their proper development and expansion, both the

banks and the utilities would be better equipped for conducting their respective businesses. The need certainly is there and should be brought to the attention of the leading bankers by public utility officials.

Increasing Range of Knowledge of Electric Properties of the Air

AIR is the most widely used of all insulators, but notwithstanding the volume of research as to its electric properties little is known as to their ultimate nature. With most of the experimentation that has been conducted a rough trail has been blazed, and it is only in recent years that research has developed any exact and general laws. These experiments have shown the great importance of the density of the air on sparkover, corona and other forms of breakdown, and quite simple laws have been found to apply.

Air density is dependent on both pressure and temperature, and since the former is more readily controlled in experimental studies, variations in density have for the most part been effected by variations in pressure at approximately constant temperature. New data are now offered on the influence of temperature by Messrs. Whitehead and Lee in a paper in a recent issue of the *Journal* of the American Institute of Electrical Engineers. They show that the laws of corona formation as heretofore accepted have the same form within the new region explored, although there is some indication that beyond the ranges more commonly met in practice there may be changes in the values of the constants. Continuous potentials were used and differences between positive and negative corona observed by others are found to be even more marked in the new range. The value of such experiments lies not so much in the possibility of immediate application of the results as in the additional contribution made toward a more complete knowledge of the laws governing electric breakdown.

Design Data for Operators of Synchronous Machines

DESIGN data are commonly regarded as of interest or value to the designing engineer only, but obviously such data are also of almost equal importance to the engineer who selects machines to meet his requirements. A good understanding of the effects of speed and kva. rating upon weight, cost and efficiency is essential. Moreover, the man having control of operation becomes a better operating engineer if he has a fair understanding of electrical machine design.

In the design of any permanently adopted series of electrical machinery each factory ordinarily establishes a system of classification and division of parts, so as to facilitate the construction of successive sizes. It is also customary to prepare data sheets, often in the form of curves, by the aid of which a designer is able to select the most satisfactory combination of elements and qualities for the purpose in view.

Theo. Schou, in his article on this subject appearing in this issue, shows a number of curve sheets of this kind. By consulting these curves not only the designer but the operating engineer can estimate the probable weights, efficiencies and excitations for synchronous machines up to 1,000 kw., when running at assigned speeds in revolutions per minute. Although this series of curves pertains, strictly speaking, only to a particular make and series of synchronous machines, yet it is evident that it must also apply more or less closely to any make and series of machines of the same general type.

It is instructive to observe how much depends upon the speed of rotation in the cases represented by the curve sheets. The effect of an increase in speed in a machine of given kva. output is always to raise the efficiency, lower the weight and reduce the excitation within the range of speeds carried by the diagrams.

Resourcefulness of the Engineer Under Adverse Conditions

IT IS not often in these days that a new generating station possesses any conspicuous individuality as distinguished from others of approximately the same size. Perhaps standard construction would have been the fate of the new Delaware station of the Philadelphia Electric Company if war conditions had not intervened and compelled somewhat radical departures which in the long run will probably more than justify themselves. At the beginning of the war the urgent and tremendous call for industrial power was very strongly felt in the Philadelphia territory, and the Philadelphia Electric Company promptly set about meeting whatever demand might arise. As in many other instances, it was clear that a considerable part of the rush demand might be for a relatively short time, but on the other hand it was indubitable that in the natural march of events the new construction would merely forestall a little the inevitable permanent demand for more power. The site chosen was on the Delaware River in the middle of the Kensington industrial district, close to its load center, and particularly well situated for the supply of coal and condensing water.

The design and specifications were ready and all preliminary arrangements made for a structural steel building, when the lid was clapped on the steel supply and something else had to be done under pain of indefinite loss of time. Hence the engineering department turned around and redesigned the whole equipment for reinforced concrete instead of steel. Here was where the primary difficulty appeared, for the situation demanded fairly compact construction and reinforced concrete will not stand the loadings permissible with steel. Therefore very careful adjustment to the new conditions was required. Construction was started, only to be slowed down by unavoidable conditions until the war was over; and almost a year beyond the armistice passed before the final program of construction was entered. By this time the reinforced-concrete construction had gone far enough to make it uneconomical to change back to steel, even though this metal was becoming available at that time.

The boiler equipment is worth more than a passing mention. The engineers looked ahead in the matter of furnaces and set the boilers well up, providing a very large furnace volume. The steam pressure is set at 250 lb. and the superheat will range from 170 deg. to 220 deg. Fahr. Fifteen retort underfeed stokers are assigned to each boiler. The big combustion chambers provided are planned with two objects in mind—first, the increased economy at high ratings and, second, provision for possible future conversion to fuel oil or powdered coal. Change to either of these fuels can be made without great modifications of the present arrangements, and either may very possibly become an important factor in station operation long before the new equipment has neared the span of reasonable use.

Concrete construction made somewhat difficult the provision of very large overhead bunkers. For this reason the coal-unloading provisions were exceptionally complete. The supply pier is big enough to allow four 1,000-ton coal barges to be tied up on each side, while just out in the river is an available island on which 200,000 spare tons can be stored. The barges are unloaded by duplicate grab buckets, electrically operated, which discharge into duplicate hoppers. Electric separators pick out casual iron before it stalls the crushers, and from the crushers the coal goes over duplicate belt conveyors to cross belts that run over the firing aisles.

The auxiliaries are divided between turbine drive and motor drive, there being duplicates of every important pump. The general rule has been to take no chances and to carry the principle of duplication virtually from one end of the plant to the other. In general, one set is motor-driven and the other turbine-driven, but occasionally there is a duplex drive. Each boiler is equipped with two individual induced-draft fans. One fan will carry the load up to 175 per cent of its rating, and the other will carry the load up to the limit of more than 300 per cent.

The Delaware station is certainly a first-class example of the finesse of the engineer when he is apparently cornered by adverse building conditions.

Another Example of the Economy of Electric Heat for Industrial Processes

THE peculiar usefulness of electric furnaces in the field of industrial heating has made itself amply evident in a good many fields. Core baking, tempering, annealing, japanning have all been successfully performed by electrical means, and the fundamental reasons for success have been in each case substantially the same. The complete control of temperature and the possibility of duplicating conditions with each succeeding charge have so quickened the operations and reduced the amount of inferior work that the question of cost of the heating agent has absolutely dropped out of sight as inconsequential, although it has been proved in every case to be reasonably low.

With the old enameling furnaces operated by coal oil or gas it had proved extremely difficult to maintain and hold steadily to the necessary temperature of about 1,700 deg. Fahr. Mufflers would sag or break, sulphur or fumes would work in and injure the enamel, so that shutdowns and loss of production proved somewhat serious. While the electric furnace built on the ground and with the box-type heating costs more to install and to run than the older types, it permits from 30 to 50 per cent more charges per hour and 25 per cent more stock for each charge. There is substantially no maintenance expense and no loss of production due to maintenance.

Furthermore, the absolutely steady heat which is provided and the perfect control greatly improve the average quality of the product, so that from a practical standpoint enameling can be done in such a furnace more cheaply than in any other. The guarantees on temperature maintained and demand made when the furnace was started up were readily met, while the guaranteed production of eight pounds of material per kilowatt-hour was greatly exceeded and the length of the operating cycle was cut in two.

This experience furnishes just another chapter of the same old story of the immense efficiency of electric heating from the standpoint of actual production. No other source of heat is so easy of application and so completely dependable as to results.

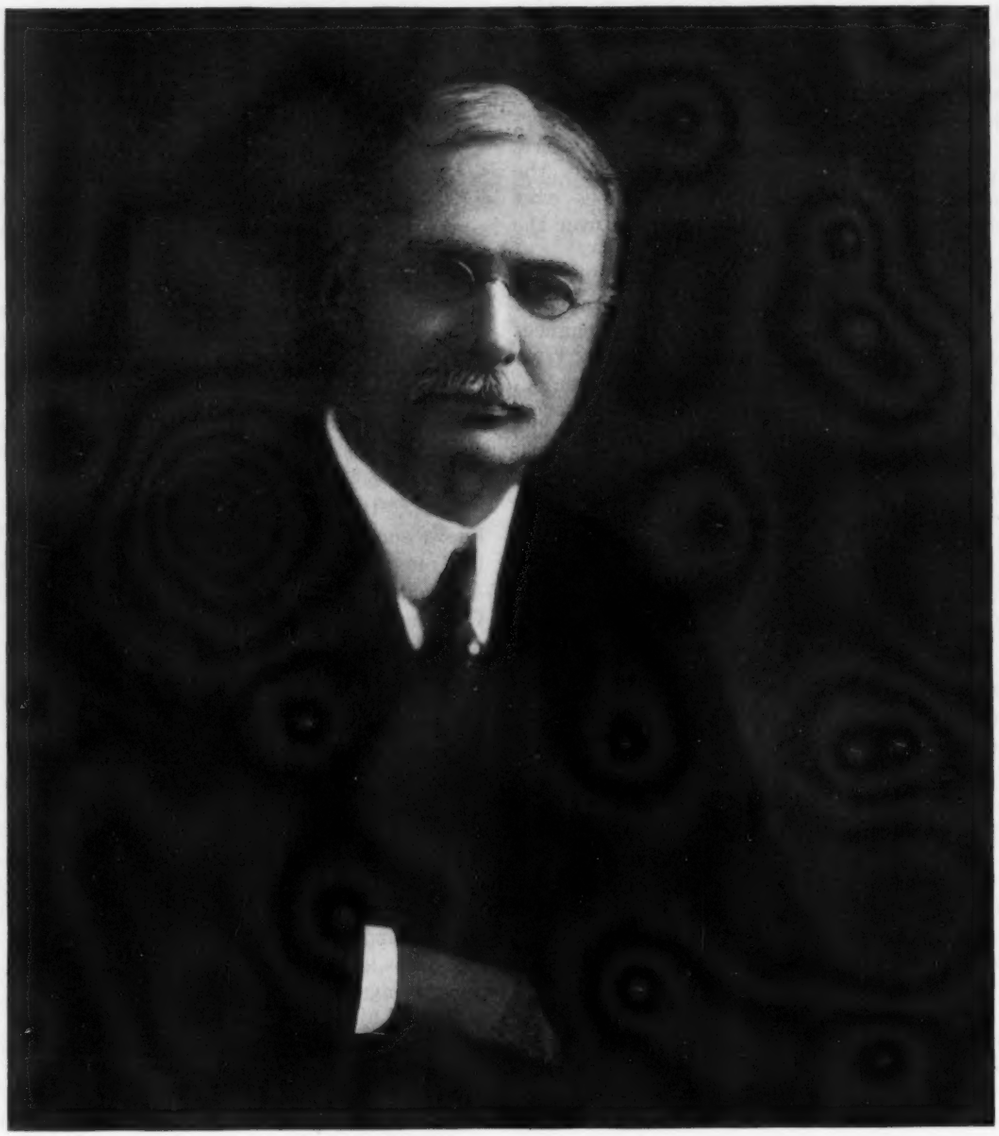
A British View of Our Turbine Practice

SOMETIMES it is a good thing to hear from a source somewhat outside of local engineering discussions what those who are taking a bird's-eye view of American practice really think of us and our lines of action. Just such constructive information is furnished in a paper presented recently before the British Institution of Electrical Engineers by Mr. Baumann taking up somewhat in detail the modern steam-turbine problem.

Looked at in a large way, development has on the whole been toward the maximum possible size at the greatest available speed. This combination, other things being equal, means some improvement in economy and a material difference in first cost per unit of output. In the driven machines there is, as we all know, some difficulty after large sizes are reached, for the reason that the combination of immense speed and high output favorable to the turbine is unfavorable to the generator when pushed to the point necessary in directly driven turbine practice. For ordinary frequencies the single unit for both turbines and generators has been pushed up to about 30,000 kw. to 35,000 kw., at which point the increasing difficulties of the situation have tended to call a halt. The composite units of 60,000 kw. and 70,000 kw. look rather promising. An interesting feature to which Mr. Baumann calls attention, particularly with reference to English and Continental practice, is the increasing use of mechanical reduction gear to unite the good qualities which come from rather high turbine speed and moderate dynamo speed. The gain in efficiency in the smaller machines seems to be very well established.

Striking features of the data presented by the English observer are those which relate to effects of pressure and superheat on ultimate economy. There has been a steady improvement in turbine efficiency, so that the questions now raised pertain to ultimate rather than to ordinary values. At the present time pressures of 350 lb. per square inch and final steam temperatures up to 750 deg. Fahr. are not uncommon. The problem of the future is to extend one limit or the other or both. Final temperature is getting at present to a point where the resisting power of hot materials must be taken seriously into consideration. Pressure by itself has reached a point where it is not altogether easy to design high-efficiency turbines, and the higher the pressure the more difficult it becomes. Mr. Baumann's deductions are that doubling the pressure from the present limit will actually slightly decrease the final efficiency, while doubling the superheat will slightly increase it.

It looks very much as though further advances are likely to come through improvements in material rather than increase in thermodynamic efficiency. It certainly does not pay to work for bigger or more efficient units at a reduction of the factors of safety. After all, as Mr. Baumann estimates, the cost of the turbines in large units today is only about 9 per cent of the total cost of the big power station, and it most emphatically does not pay to take chances with continuity of service for a modest saving in first cost over this small figure.



Edward Bennett Rosa

Scientist of marked ability, chief physicist of the Bureau of Standards, and author of the plan for national safety standards conceived while developing the National Electrical Safety Code

THERE was lost to the electrical industry this week a man whose name will ever be linked with the progress of the art. It is with deep regret that the death of Dr. E. B. Rosa, since 1910 chief physicist of the United States Bureau of Standards, is recorded. He died at his work Tuesday afternoon. As a pure physicist alone he by his accomplishments and studies won for himself a place of honor among the foremost scientists of the day. But he was more than that. He was an executive, guiding carefully and intelligently the work of more than a hundred technical assistants and was immediately responsible for building up the electrical division of the bureau. Of late years he gave a great deal of consideration to what might be called practical sociology. In this work he was more deeply interested, probably, than in anything that has gone before. He approached it from the point of view of making electricity safe. The details of what is now known as the National Electrical Safety Code were worked out in the bureau's electrical division under his supervision. Dr. Rosa subsequently expanded the safety movement to such an extent that the bureau is now working on a national program of safety codes covering gas, the protection of head and eyes, aviation, logging and sawmills, mining, foundries and other activities. In all of these undertakings he always invited the co-operation of the industry affected in order to give full consideration to the viewpoint of that industry.

Some of the scientific work done under his supervision by the electrical division of the bureau may be mentioned to indicate the high order of his endeavors. This work includes the redetermination of the ratio of the units of electrical measurement, the measurement of the electrochemical equivalent of silver, invention of new methods for measuring capacity and inductance, calculations of electrical characteristics of coils, specifications of the international candle, and electrolysis research.

Dr. Rosa was born in Rogersville, N. Y., in 1861 and was graduated from Wesleyan University, Middletown, Conn., in 1886. Five years later he received his doctor's degree from Johns Hopkins University. He returned to Wesleyan as a professor of physics, where he invented a number of measuring instruments, besides conducting important investigations in dielectric measurements, alternating-current wave forms, electromagnetic units, etc. In 1901 he joined the Bureau of Standards as a physicist. He was a fellow of the American Institute of Electrical Engineers, a former director of the Illuminating Engineering Society and was one of the most active members of the American Engineering Standards Committee.

Dr. Rosa had been a member of the International Electrical Commission, was honorary secretary of the International Electrical Congress held in San Francisco in 1914, and in 1913 was elected to the council of the French Physical Society.

Compact Reinforced-Concrete Generating Station at Philadelphia

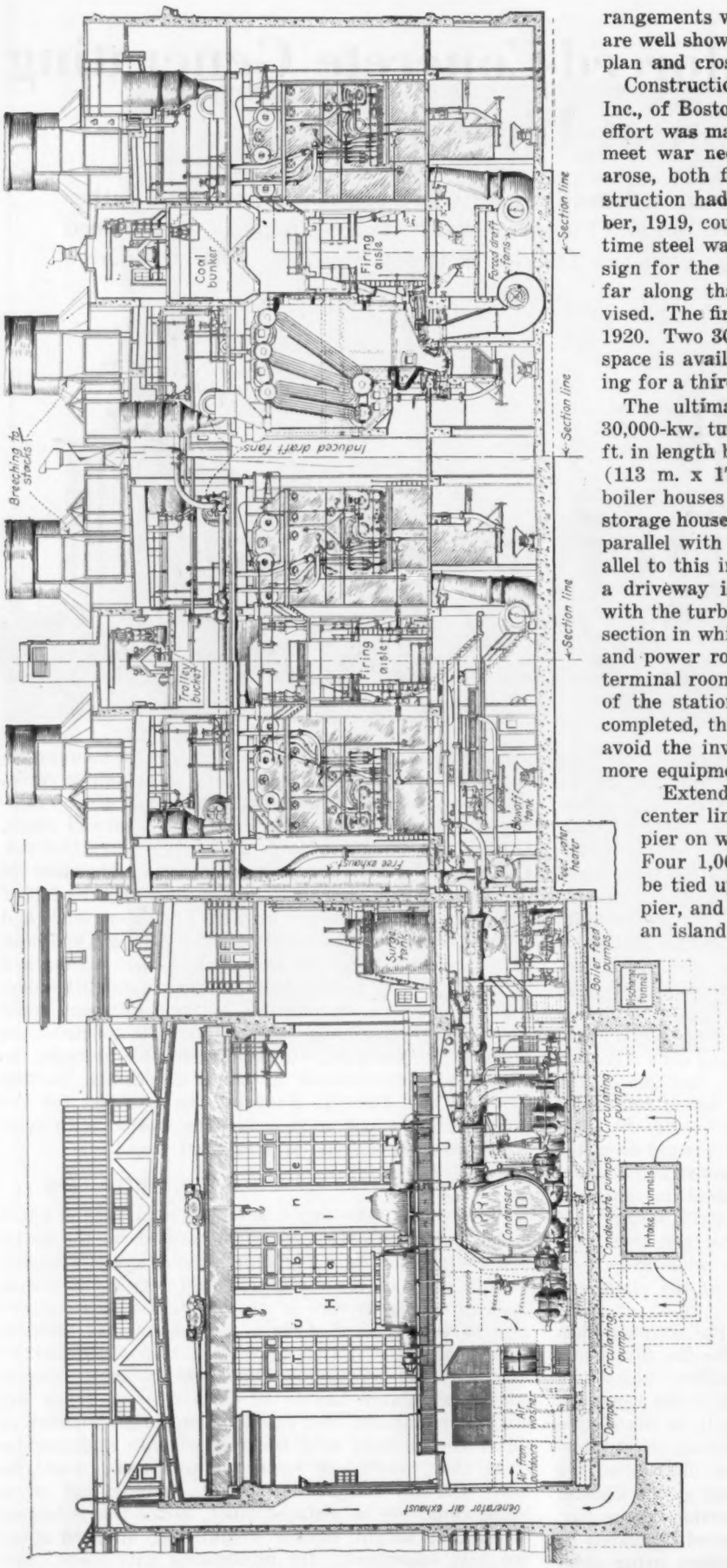
180,000-Kw. Station Designed and Built Under War-Time Difficulties with Rather Unusual Coal-Handling Facilities and Furnace Construction—Supply of Boiler-Feed Water and Duplication of Auxiliaries Divided Between Steam and Electric Drive

GENERATING-STATION design is becoming so standardized that little can usually be found in new plants that is radically different from others built about the same time. However, in the new Delaware station of the Philadelphia Electric Company some departures from usual practice have been made that should be of considerable interest to other companies which may have to build stations under similar conditions. Delaware station is particularly interesting because serious obstacles imposed by market conditions and building space were overcome in its design and because special attention was devoted to preserving continuity of operation under almost any operating condition, involving even a change to oil or powdered fuel. Among the features of the mechanical part of the station are the use of reinforced concrete instead of structural steel in the building structure, the high rating per unit of ground area, the coal-handling facilities, the furnace construction, convertibility of furnaces to oil or powdered-fuel burning, provisions for assuring reliable auxiliary service and method of supplying boiler feed. These and other features will be discussed in this issue, while important characteristics of the electrical part of the plant will be presented in a later issue.

Like all progressive companies, the Philadelphia Electric Company is continually planning for the future and had a development involving the Delaware station laid out long before there was any thought of the European war. Two stations were planned—one to be the station considered in this article for supplying the rapidly growing industries in the Kensington district on the Delaware River; the other, to be known as the Chester station, for supplying the southern portion of the city. The two plants were to be interconnected ultimately to serve the entire community, if necessary using older stations as relays. When the war came, with its unprecedented demand for power to supply shipbuilding yards, machinery manufacturers, textile mills and other Philadelphia industries, the Chester station was well along, but the Delaware station was not under construction yet. Owing to the emergency, however, the completion of the design and specifications was pushed. By the fall of 1917 arrangements for building the plant were made and orders for most of the material and equipment had been placed, but, like other companies which were willing and ready to provide greatly increased power facilities during the war, the Philadelphia Electric Company could not obtain the necessary structural steel to construct the plant as first designed. Undaunted by this obstacle, the engineering department of the Philadelphia Electric Company and John T. Windrim, the architect for the building, undertook to redesign the station with reinforced concrete instead of structural steel.

Designing for Concrete Not a Simple Task

Since there were only 5 acres of total ground space available and only 3¼ acres could be used for the building, the problem of using reinforced-concrete construction in place of the structural steel was not a simple task, especially in view of the low unit stresses allowable in this type of design. In general the problem was to make the station as compact as possible without exceeding the permissible structural loadings. Consequently a balance had to be made between types and sizes of equipment that could be supported without so filling the building with concrete columns and foundations that insufficient room for equipment would be left. Certain things, like boiler, turbine and crane loads, could not be reduced much, hence the reduction of building height, bunker weight, etc., afforded about the only opportunity for minimizing unit loads. Ar-



OPERATION ON THE UNIT PRINCIPLE AND DUPLICATION OF AUXILIARIES ARE FEATURES OF THIS STATION

rangements which were made to solve the problem are well shown in the accompanying exterior view, plan and cross-section of the station.

Construction was started by Stone & Webster, Inc., of Boston, the contractors for this plant, and effort was made to hasten its completion and thus meet war needs, but new and repeated obstacles arose, both financial and otherwise, so that construction had to be postponed. Not until September, 1919, could construction be resumed. By that time steel was more readily available, but the design for the reinforced-concrete structure was so far along that it could not be economically revised. The first unit was put in operation October, 1920. Two 30,000-kw. units are installed now and space is available in the present part of the building for a third unit.

The ultimate station, which will contain six 30,000-kw. turbo-generators and will measure 373 ft. in length by 367 ft. in depth by 91 ft. in height (113 m. x 172 m. x 27 m.), will consist of two boiler houses next to the river and separated by a storage house. On the land side of these buildings, parallel with the river, is the turbine hall. Parallel to this in turn but separated by the width of a driveway is the electrical bay. This is joined with the turbine hall from the second floor up by a section in which are the battery room, station light and power room, offices, control room, and circuit terminal room. As may be observed from the plan of the station, only about half of the station is completed, the arrangement making it possible to avoid the investment in the entire building until more equipment is needed.

Extending out from the bulkhead along the center line between the two boiler houses is a pier on which stands the coal-unloading tower. Four 1,000-ton to 1,500-ton coal barges may be tied up in the space along each side of the pier, and a further coal reserve is available on an island which is approximately opposite the station and on which several hundred thousand tons of coal can be stored.

Because of the fact that the coal bunkers over the boilers had to be made relatively small to keep the unit loadings on the reinforced-concrete columns within safe limits, it was particularly important in this station that there should be no interruption in unloading of coal and delivery to the bunkers. Therefore duplicate coal-handling facilities were provided between the coal barges and the bunkers.

The coal tower is equipped with electrically operated boom hoists, with 1¼-ton grab buckets for unloading from each side of the pier. They are operated from control rooms in the upper floor of the tower, from which points the barges may also be moved

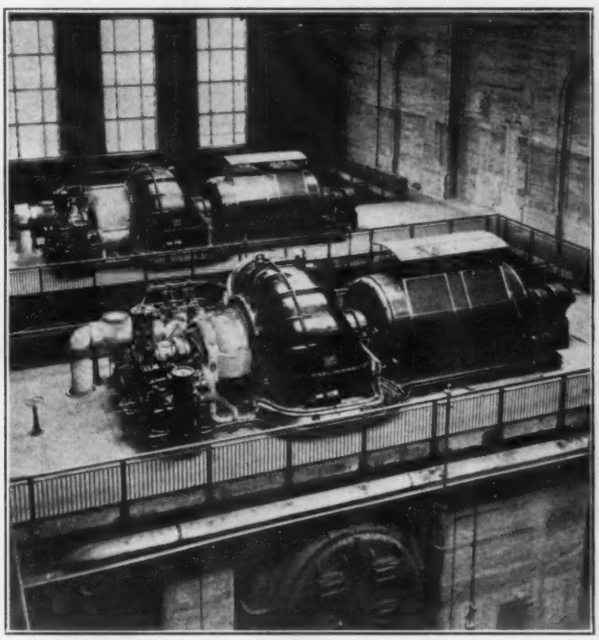
alongside the pier by means of an electrically operated barge-hauling machine and a cable to which the barges are fastened. From the two 30-ton hoppers into which the buckets discharge, the coal goes by gravity onto picking tables, where large foreign material is removed, and thence to crushers over magnetic pulleys, which remove the smaller pieces of metal such as scrap iron, bolts, etc. The crushers discharge onto two traveling inclined-belt conveyors which run above the pier and transfer their load to cross belts over each firing aisle. The inclined conveyors are equipped with weightometers, which weigh all the coal passing into the station.

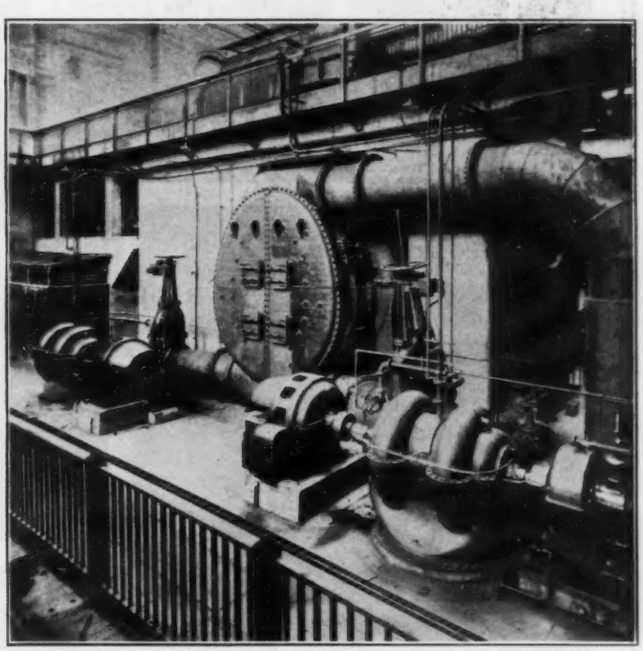
Coal for either receiving hopper can be delivered to either one of the crushers, and the crushers can in turn discharge directly to either one of the inclined-belt conveyors. The inclined-belt conveyors are also so arranged that either conveyor can deliver its coal through cross conveyors to any one of the four bunkers in the two boiler houses. A fire wall is provided between the two inclined conveyors, and the conveyor tunnels are well ventilated to minimize fire hazard.

The bunkers into which the cross belts distribute their load have a capacity of about 88 tons per boiler. Such small bunkers were considered feasible, however, because of the proximity of the coal-storage yard, the possibility of storing coal barges each side of the pier, the duplicate coal-handling facilities and the proximity of the Port Richmond Coal Terminal, through which nearly all coal is delivered to the system. To guard still further against any possible interruption of coal delivery to the boilers, a one-man trolley with grab bucket is installed over each bunker so that coal may be transferred from one section of the bunker to any other section, and arrangements will be made for elevating coal dumped from railroad cars or automobile trucks to the picking tables in the coal tower.

Eight Stirling boilers, each having 15,080 sq.ft. (1,387 sq.m.) of heating surface and 3,950 sq.ft. (363 sq.m.) of integral economizer surface, are installed, although twenty-four will be provided ultimately. The boilers are set unusually high, the upper drum being about 33 ft. (9.6 m.) above the floor level. With the construction employed, the unusually high furnace volume of 4.8 cu.ft. (1.3 cu.m.) per rated horsepower is obtained. The boilers and auxiliaries are installed to permit operation at 330 per cent of boiler rating. The steam pressure is 250 lb. gage (17.5 kg. per sq.cm.), and the superheat will range from 170 deg. to 220 deg. Fahr. Fifteen-retort, special-width underfeed stokers with double-clinker grinders are installed under each boiler. The projected grate area is about 0.2 sq.ft. (186 sq.cm.) per rated boiler horsepower. Direct-current motors are used to drive the stokers and are mounted below the firing aisle.

Other interesting characteristics of the boiler room are the individual forced-draft fans for each boiler, duplicate induced-draft fans, breechings on the roof running to stacks which serve three boilers each, provisions for supplying boiler-feed water, the boiler instrument and control boards and the test boiler for working out constants to guide the operators.





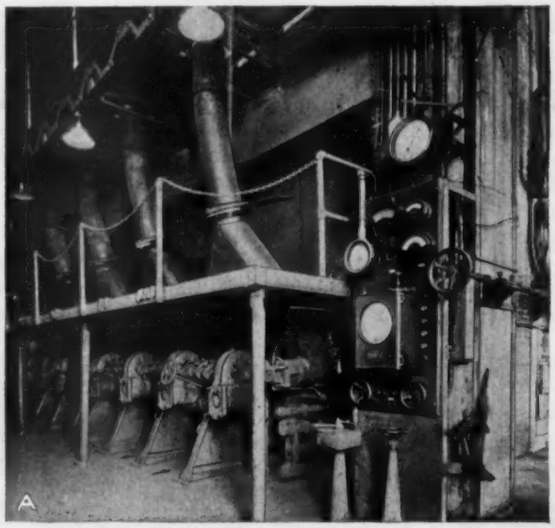
EACH 30,000-KW. TURBO-GENERATOR IS SUPPORTED ON AN ISLAND FOUNDATION; ON THE RIGHT IS THE ARRANGEMENT OF CONDENSER AND CIRCULATING PUMPS EMPLOYED

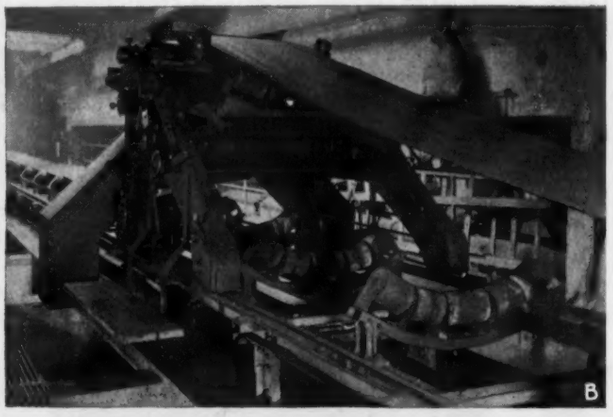
One induced-draft fan is sufficient to serve one boiler up to 175 per cent of rating. Above this load two fans are required. No provision has been made for interconnecting forced-draft air ducts, stoker drives or fan motors because the advantage gained is not considered worth the expense. It is always possible to start up another boiler if necessary, working the remaining boilers at overload until the incoming boiler is placed on the line.

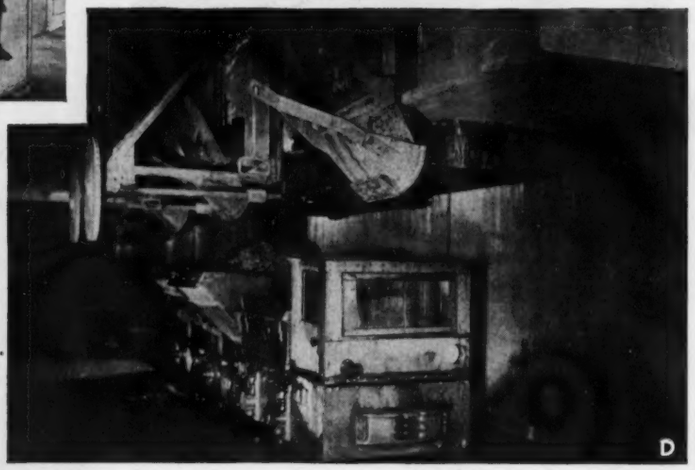
HIGH AND SPACIOUS FURNACES

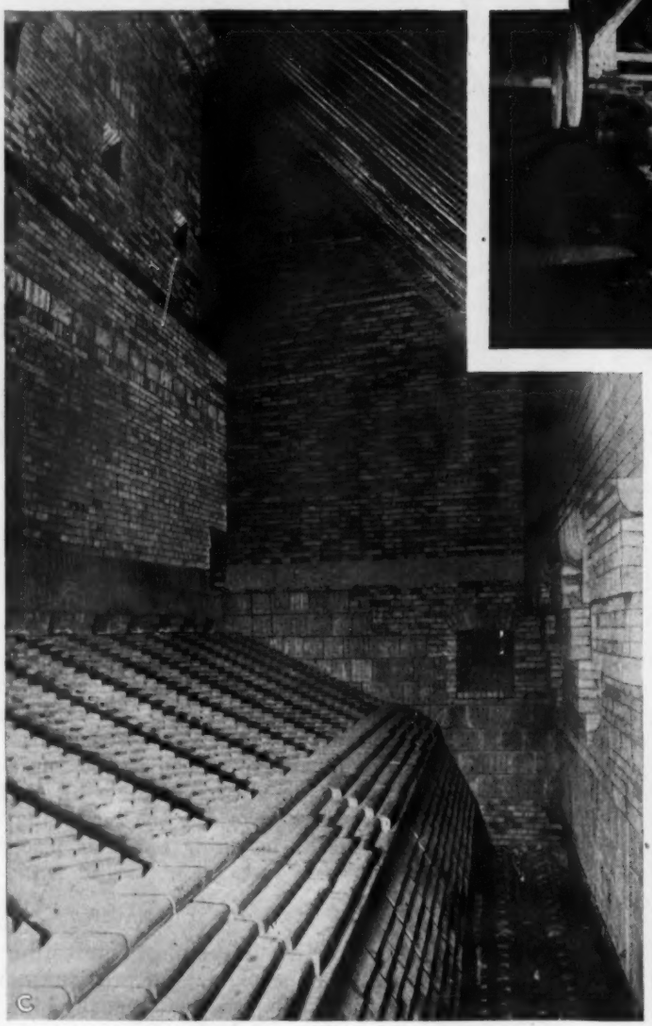
The furnace construction is the most interesting mechanical feature inside the plant. As previously mentioned, the combustion chambers are unusually high and spacious. Consequently very high economy can be obtained even at high boiler ratings since more complete combustion can take place before the gases strike the tubes. Another feature of the furnaces is that they may be readily adapted to burning oil, powdered an-

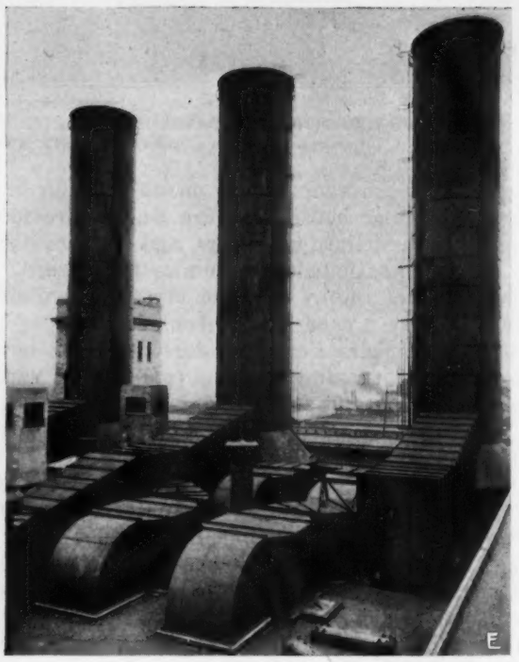
Provisions for Handling Fuel and Products of Combustion at Delaware Station











A—One of the 1,500-hp. boilers with instrument and control board close by.

B—Coal distributer in one of the cross conveyors over one of the bunkers.

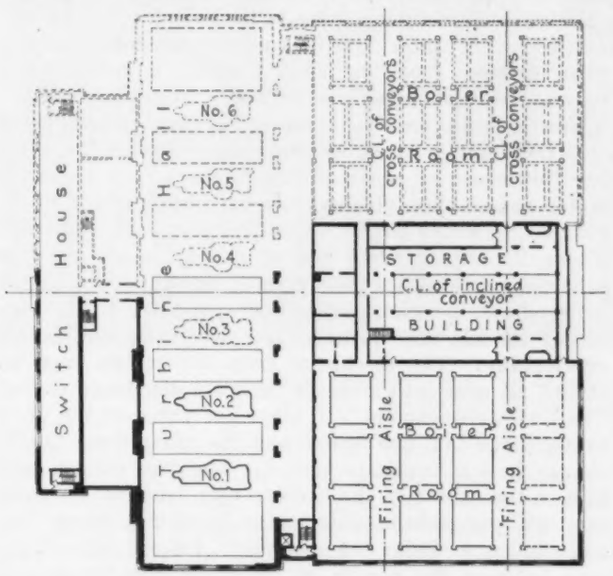
C—Interior of one of the furnaces showing stokers below and first bank of tubes above.

D—Storage-battery hauled cars below ash hoppers.

E—Breechings leading to stacks.

thracite or powdered bituminous coal. Methods of converting the furnaces without greatly changing the present installation are indicated by the accompanying cross-sections.

Serious consideration was given to convertibility of the furnaces because it is believed that burning of powdered fuel may eventually be a very desirable method of firing coal at this station, while the burning of fuel oil would be considered even now if it could be



LAYOUT OF EQUIPMENT FOR 180,000-KW. STATION

made available under advantageous contracts. If powdered fuel is ever used, the preparatory equipment such as pulverizers and driers could be installed on the pier or in the present storage house between boiler rooms.

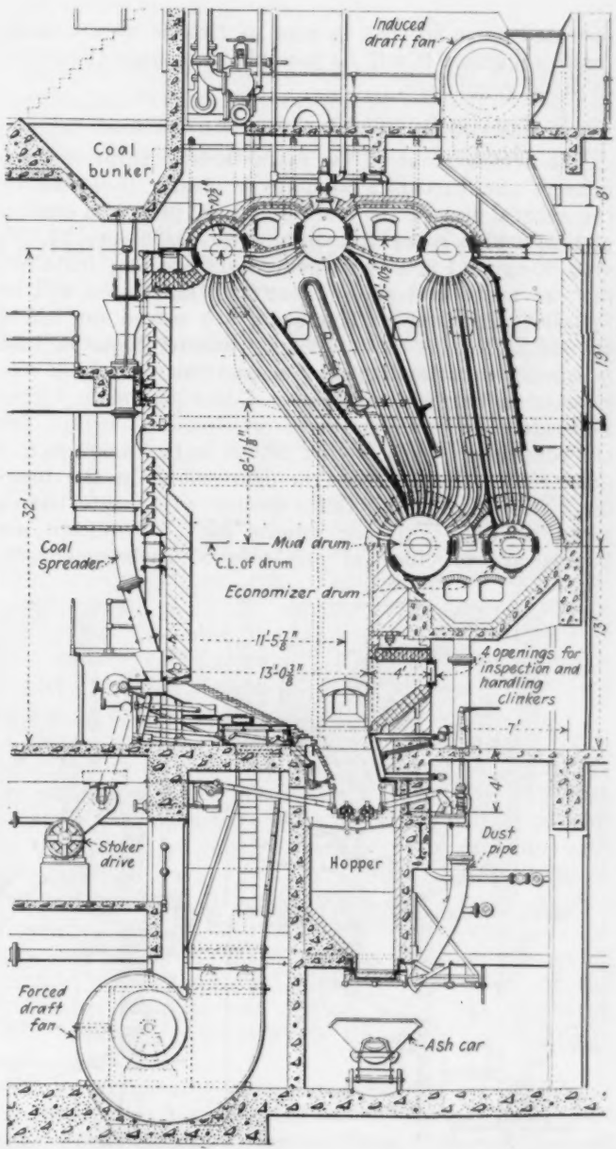
Aside from the foregoing characteristics, the furnaces have the following points of interest: A very wide throat just back of the stokers which will prevent clinkers arching across the cinder grinders; the provision of doors for observation of fire condition and handling of clinkers at the back of the furnaces within very close range of the clinker grinders, and the support of the major portion of the front boiler wall on structural steel separate from the stokers. Steel casings were not considered necessary because it was believed that with 13¼ in. (33.6 cm.) of well-laid firebrick on the interior of the furnace and 8½ in. (21.2 cm.) of red brick outside, with an air space between, radiation and air leakage could be kept at a minimum.

Under each furnace is a 1,000-cu.ft. (28-cu.m.) reinforced-concrete ash hopper to be fitted with air-operated gates discharging direct into 1½-cu.yd. (1.14-cu.m.) ash cars. When the station is completed duplicate skip hoists will be provided to which the ash cars will be hauled by storage-battery locomotive and dumped. The hoists will elevate the ashes to hoppers from which they may be discharged into barges, railroad cars or motor trucks.

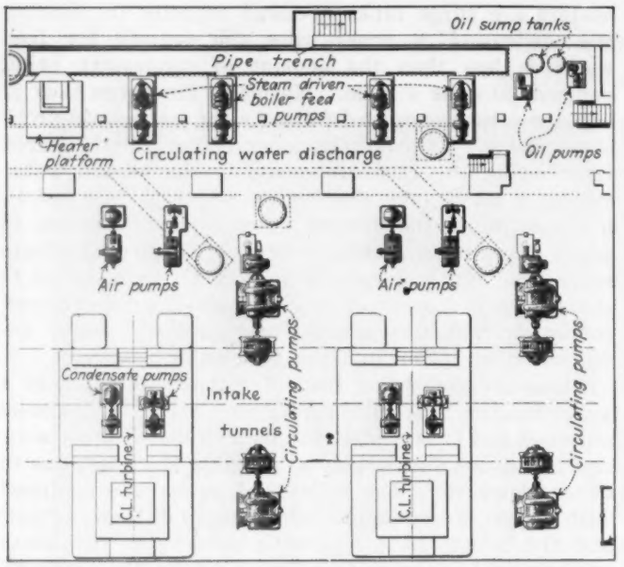
BOILER-FEED WATER SYSTEM

The normal boiler-feed water supply is the condensate from the main units. This condensate passes first through the waterbacks in the boilers, where its temperature is raised about 10 deg Fahr, then directly to open feed-water heaters. In the line to the feed-water heaters are surge tanks of large capacity for storing the condensate at times when the demand for feed water is less than the amount of condensate being pumped into the system. Normally the surge tank is kept more than one-third full. As the water-level drops below normal a float valve operates to admit filtered river water. In case of trouble in the filtered water system a long-range float valve, which is inserted in a standpipe on the filtered water system, operates to admit city water into this system. This gives duplicate sources of supply for make-up water. In addition to these normal sources of supply there is an emergency connection which by manual operation will admit unfiltered river water into the feed-water system.

Plans are now being made for the installation of a water-treating system to supply pure water for make-up purposes and thus protect the boiler tubes against scale and to cut down as largely as possible the losses due to boiler blowdown. The boiler-feed pumps are equipped with pressure regulators which control their output, and the boilers have automatic feed-water regulators on one end of the feed-drum, while the opposite end of the feed drum is connected through a hand-



UNUSUALLY LARGE COMBUSTION CHAMBERS ARE PROVIDED



SECTION OF FLOOR BELOW TURBINES INDICATING DUPLICATION OF AUXILIARIES

operated valve so that in case of trouble on the automatic regulator it will be possible to operate the boiler by hand regulation.

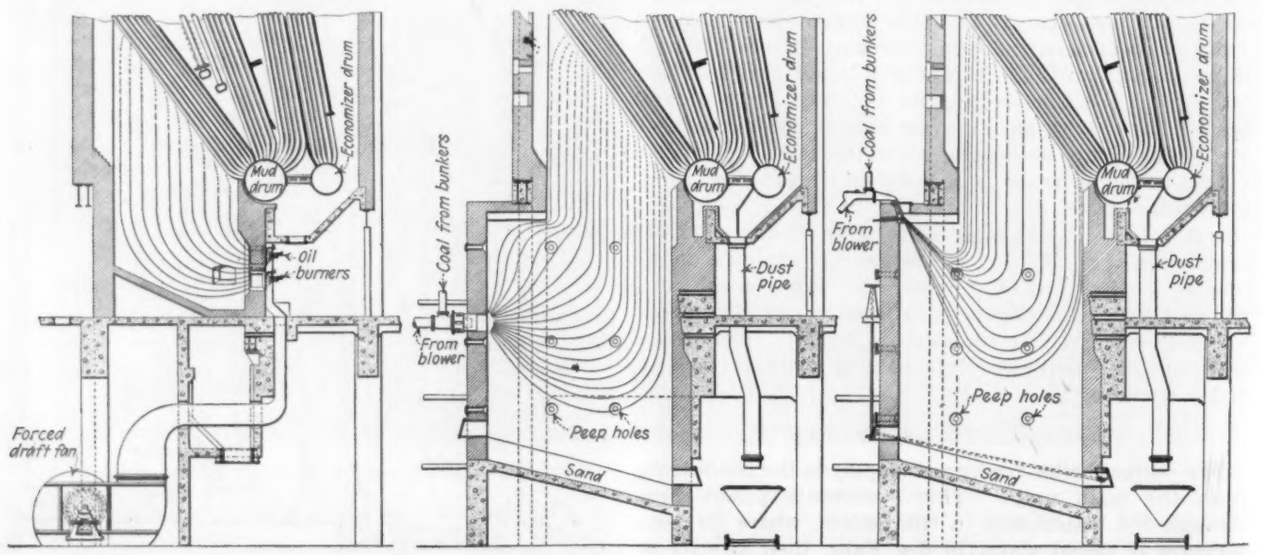
MAIN UNITS AND THEIR AUXILIARIES

The arrangement of the main turbo-generators, condensers and various auxiliaries is clearly indicated by the general plan of the station and the plan of a section of the turbine room basement. Two 30,000-kw., 13,200-volt, 60-cycle, 1,800-r.p.m. generators are now installed, and, as mentioned before, four additional ones will be installed ultimately. The units are placed on island foundations—*i.e.*, the only floor around them is that necessary in attending to the particular machine and in passing between machines. Under the main turbo-generators and supported on multiple-coil springs are the condensers, each having 50,000 sq.ft. (4,600 sq.m.) of surface. Below these in depressions in the basement floor are the duplicate cooling condensate pumps rated at 1,500 gal. per minute each. Duplicate air pumps are provided at one side of each condenser. The boiler-feed pumps, of which there are four turbine-driven units rated at 1,000 gal. per minute (two for each feed-water heater), are also installed on the turbine-room basement floor. Various other pumps, refrigerating and other equipment are installed in a pump room several feet below the auxiliary floor. As will be observed from the plan of a section of this floor, all important auxiliaries are in duplicate and, except for the boiler-feed pumps, consist of one motor-driven and one turbine-driven unit. In the case of the circulating pumps duplex drive is furnished.

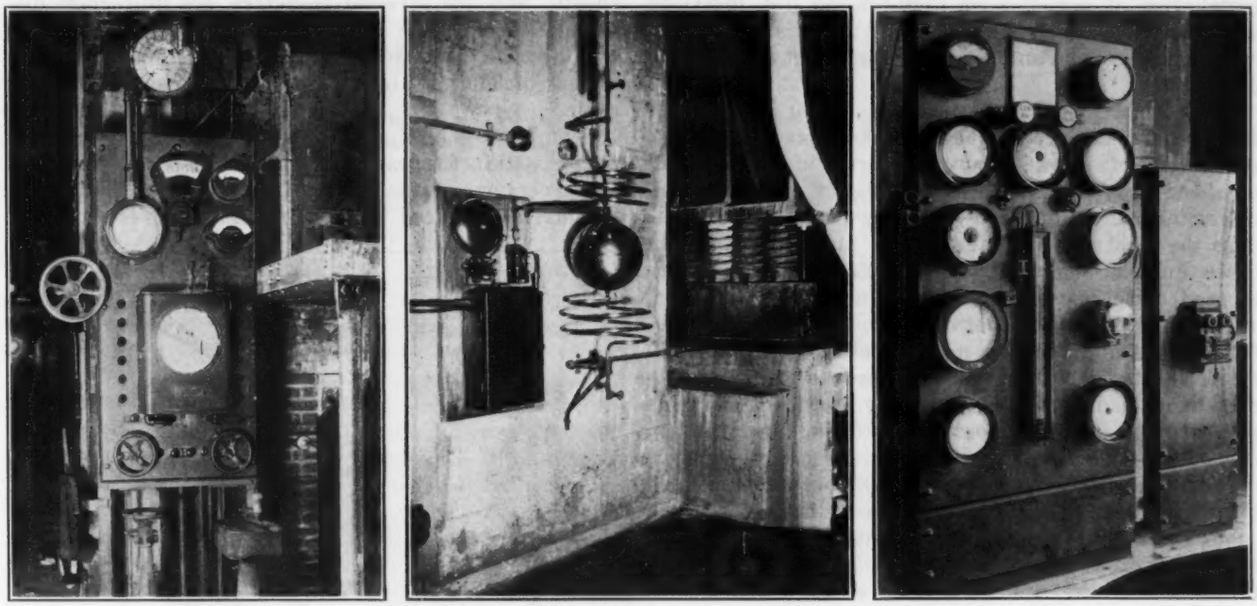
Circulating water for the surface condensers is supplied directly from the river through a screen basin in which are installed six vertical screening elevators. These screens are so installed in the screen house that they can be lifted out and removed from the building for repair or renewal. From the screen basin the water passes through duplicate concrete tunnels to the circulating water pumps. One pump on each main unit draws its supply from one of these tunnels and the other pump takes its supply from the duplicate tunnel. This allows the plant to be operated even though one of the tunnels may be taken out of service for repairs or cleaning. The discharge from the pumps now installed all goes into a single concrete discharge tunnel. The final arrangement will allow for three of the units to discharge into one tunnel and the other three to discharge into a duplicate tunnel. The two tunnels will join in the center of the turbine hall, from which point they will run side by side to the bulkhead, where they will discharge under the coal pier. On the side of the pier between the mouth of the discharge tunnel and the screen basin is a baffle wall of sheet piling which will force the warm discharge water so far out into the river that no recirculation is likely to occur, which would result in raising the temperature of the incoming circulating water.

HEAT BALANCE

When the auxiliary system was designed for this plant it was determined to provide the necessary equipment to insure boiler-feed-water temperatures of about 210 deg. Fahr. to give protection against pitting of the economizer tubes and piping because of air which might be entrained in the water. At that time the only prac-



THE PRESENT FURNACES MAY BE ADAPTED TO BURNING OIL, POWDERED BITUMINOUS OR POWDERED ANTHRACITE AS SHOWN



BOILER-ROOM INSTRUMENT AND CONTROL BOARD; CONDENSER HIGH-WATER ALARM; TURBINE ROOM INSTRUMENT AND CONTROL BOARD

ticable way of removing this air was by raising the temperature of the water in the open feed-water heater to the boiling point. Investigations, however, were then under way which if successful would make it possible to operate the boiler-feed system at lower temperatures, with a resulting increase in boiler efficiency. For this reason considerable thought was given to a method of obtaining a heat balance which would allow for reliable and efficient operation with feed water at any temperature between 140 deg. and 212 deg. Fahr.

Keeping in mind the reliability and operating economy obtainable as well as the item of investment, it was decided to install the condenser auxiliaries in duplicate. It was further arranged that one of each type of auxiliary would be motor-driven and the other turbine-driven. In the case of the circulating pumps one pump for the unit was driven by motor and the duplicate pump is arranged with a duplex drive, so that if the load is being carried on the motor-driven pump and there is any failure in the electrical supply the steam end will automatically pick up the load.

For obtaining the proper heat balance the base steam requirements for any desired boiler-feed-water temperature can be obtained through the use of the steam-driven boiler-feed pump together with the required number of steam-driven condenser auxiliaries. Fluctuations in normal operation can be offset by regulation of the steam load carried on the duplex circulating pump. The regulation of the feed-water temperature with this arrangement is entirely under control of the man responsible for the operation of this section of the plant apparatus. A bleeder connection has been provided at the eleventh stage in the main turbines, but with the flexibility obtainable with the system as designed it is expected that this method of obtaining heat balance will not be used.

As in the boiler room, the instruments and control are grouped for convenience of operation. In line with modern central-station practice, the number of boiler-room and turbine-room instruments is considerably greater than a few years back, the additional equipment being considered essential to economical operation.

For the information presented in this article the ELECTRICAL WORLD is indebted to Joseph B. McCall, president of the Philadelphia Electric Company; W. H. Johnson, vice-president, and W. C. L. Eglin, chief engineer.

Connecting Overhead Circuits to Underground Cables

Single-Conductor Cables Used by the Detroit Edison Company to Connect Underground and Overhead Lines Without Arresters

BY A. A. MEYER
The Detroit Edison Company

OPEN-WIRE overhead-transmission lines, owing to their great exposure across country, are not immune in certain climates from troubles arising from lightning or atmospheric disturbances. Joining an underground cable to an overhead line naturally jeopardizes the cable also, and to a very great extent because the cable affords a good path to the earth for any discharges passing along the line. With lines of higher voltage such troubles are aggravated.

Experience has shown that a so-called stroke of lightning hitting an overhead line gets its relief sometimes by puncturing the cable insulation. It has also been observed that such puncturing occurs usually at a point in the cable not very remote from its junction with the overhead line. In other words, a high-voltage or steep-wave front disturbance will not travel very far through a lead-incased cable. The discharge into the cable, according to its magnitude, is either dissipated without damage or else relieved by puncture of the insulation close to the end at which the discharge entered, usually within 200 ft. (60 m.) from the cable terminal.

Quite frequently lightning arresters are advocated or installed at the junction points between the underground cables and overhead lines. The efficacy of such arresters is not to be argued here. Moreover, the

installation of arresters on high-tension line junctions with 24,000-volt cables is not always so satisfactory and so practicable from an operating standpoint as might be desired.

Some trial installations were made on the Detroit Edison Company's transmission system, involving direct connection of a 24,000-volt underground cable to an overhead line through short sections of special single-conductor cables of high-grade insulation, and omitting the lightning arrester at the junction point. In these installations the standard three-conductor lead-incased cable, having an insulation of $\frac{5}{32}$-in. x $\frac{7}{32}$-in. (7.1-mm. x 5.5-mm.) paper over No. 2/0 copper conductors, was terminated in a manhole about 200 ft. or 300 ft. from the cable pole and spliced to three single-conductor lead cables, which were carried from this point to the overhead connection. The insulation on this single-conductor cable is $\frac{21}{32}$-in. (16.6-mm.) paper, or about 31 per cent more than that separating each of the conductors from the sheath in the three-conductor cable. The increased amount of insulation is somewhat experimental and was determined largely by present limitations in the manufacture of cables of such size.

There is no doubt that the extra insulation should withstand high-voltage disturbances many times normal voltage. Then, if a lightning charge happened to seek a path into the cable, it might be absorbed or dissipated through the capacitance of the cable conductor, which, having high insulation, would suffer no damage. Of course, it must be admitted that lightning discharges are very unwieldy quantities to deal with and sometimes may be beyond the insulation limitations that can be provided. By placing only one conductor within a sheath it is practicable to increase the insulation considerably over that of a three-conductor cable, the diameter being limited to that of the duct orifice. This feature of extra insulation is probably the greatest factor in minimizing the danger of puncture to a cable. There are also other merits of single-conductor cables worthy of mention.

In a three-conductor cable each conductor is necessarily installed eccentric to the lead sheath, and the stress on one conductor to ground due to a high-voltage transient is therefore not uniformly distributed around the conductor. The potential gradient through the insulation is much greater on the side nearest the lead sheath, and the stream-line stresses are correspondingly more concentrated on the same side. In a single-conductor cable the conductor is concentric with the lead sheath, and the stresses therefore are uniformly distributed around the conductor. The chance for puncture from a high-voltage transient is therefore minimized considerably in a well-insulated single-conductor cable.

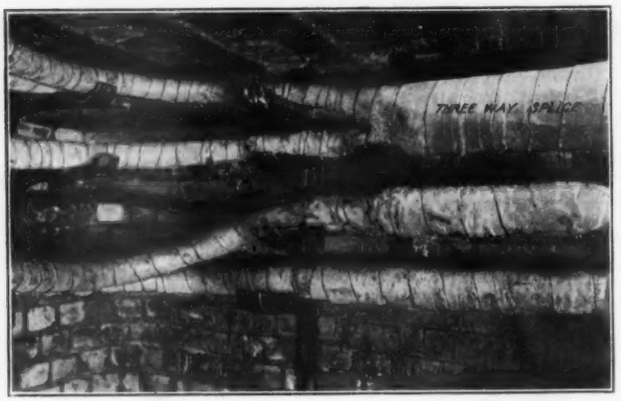


FIG. 1 — MANHOLE SPLICES OF THREE SINGLE CABLES TO A THREE-CONDUCTOR 24-KV. CABLE OFFER NO DIFFICULTIES

Owing to the concentric arrangement of the conductor within the lead case of a single-conductor cable, the capacitance is somewhat increased over that of an eccentrically placed conductor, as in three-conductor cable. In the present installation the capacitance of the special single-conductor cable is about 10 per cent higher per running foot than that of one conductor in the standard three-conductor cable. This means that the voltage stress to ground from a discharge into the cable sustained for a short time is correspondingly less on the single-conductor cable because of the greater capacitance and more rapid dissipation. Greater capacitance and more insulation, therefore, both protect the cable against possible damage from a lightning discharge.

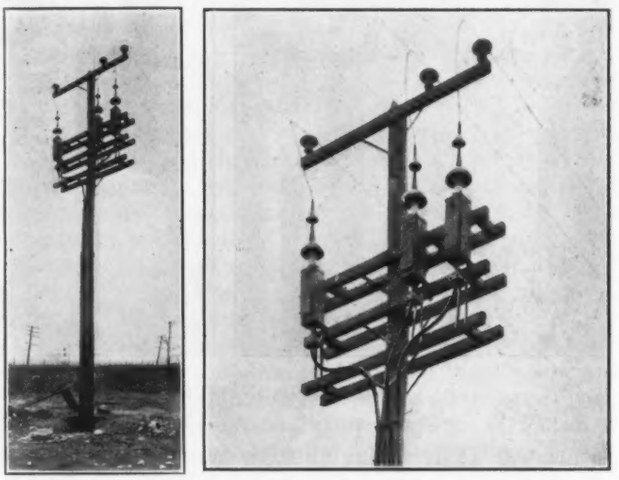


FIG. 2—SINGLE-CONDUCTOR CABLE CONNECTION TO 24-KV. OVERHEAD LINE

End bells are rectangular cast-iron boxes with hand-hole covers and roof-entrance bushings designed locally.

There are also some practical advantages in the use of single-conductor cables. It is much easier to provide and install suitable outdoor end bells for single-conductor cables than for a three-conductor cable of this voltage. The splice of a three-conductor cable to three single-conductor cables presents no difficulties, especially when it can be made in a manhole. In Fig. 1 such a completed splice is shown installed in a manhole, the splice nearest the roof being the one referred to. The three-single conductor cables are readily trained up a pole to the cable bells placed most conveniently with respect to the overhead lines. Fig. 2 illustrates one of the installations on a 40-ft. (12-m.) pole. The end bells are of local design and consist of rectangular cast-iron boxes with hand-hole covers and roof-entrance insulators. A paper-taped splice is made in each bell and the usual method of filling the bell with black compound is followed.

About four of these installations have been put into service so far, the first one having been in use since December, 1920. In this short period several lightning disturbances have occurred without damage to the present installation. However, during the coming summer, with its accompanying electrical storms, the behavior of these installations will be watched with a great deal of interest.

Legal and Financial Aspects of Superpower Plan

Superpower Survey, Advisory Board and Legal and Financial Advisers Discuss Problems Affecting the Carrying Out of the Enterprise Preliminary to Completion of Final Report of the Organizing Body

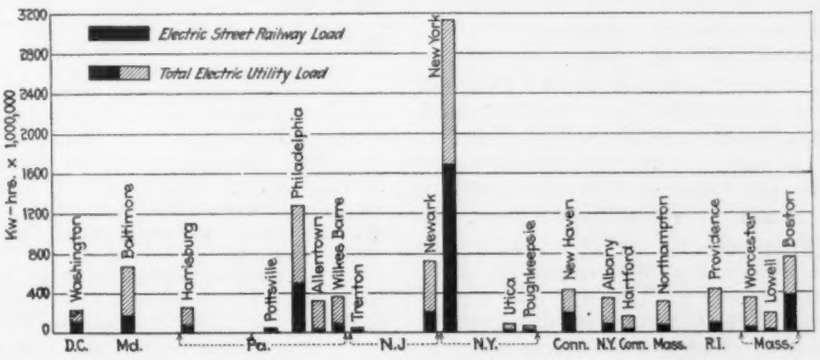
PRIOR to completing its final report on June 30, the Superpower Survey held a meeting in New York on May 13 at which members of its advisory board and several guests were invited to discuss the physical, legal and financial phases of the problems under consideration. Prof. L. P. Breckenridge, chairman of the advisory board, presided. W. S. Murray, chairman of the Superpower Survey, discussed the physical features, E. G. Buckland, vice-president, New York, New Haven & Hartford Railroad, the legal aspects and W. S. Barstow, president, W. S. Barstow & Company, the financial phases. In addition to those just mentioned, the following were present: Dr. George Otis Smith, Director of the United States Geological Survey, which is conducting the Superpower Survey; Gen. Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company; Thomas E. Murray, president of Thomas E. Murray, Inc., consulting engineers; H. I. Harriman, president, New England Power Company; A. J. Sheldon, Lee Higginson & Company; M. W. Alexander, chairman National Industrial Conference Board; C. L. Edgar, president of the Edison Electric Illuminating Company of Boston; George Gibbs of Gibbs & Hill, consulting engineers; Colonel Charles Keller, Board of Engineers for Rivers and Harbors; Arthur D. Little of Arthur D. Little, Inc., chemists; James H. McGraw, president McGraw-Hill Company, Inc.; J. H. Pardee, president J. G. White Management Corporation; Walter Thayer, Pennsylvania Railroad; Henry Flood, Jr., engineer-secretary Superpower Survey.

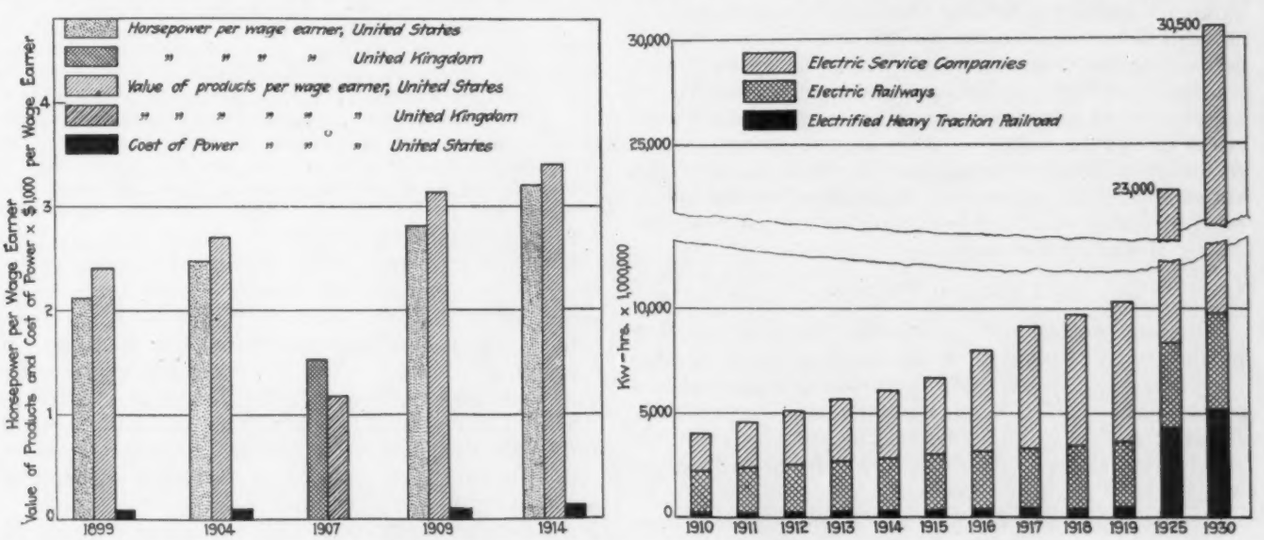
A very interesting discussion followed the presentation of the three phases of the superpower study. Features of this discussion are reported in what follows.

LEGAL PHASES

E. G. Buckland, vice-president New York, New Haven & Hartford Railroad, prefaced his remarks by saying: "A charter or other legal authority must harmonize the legislative and financial requirements."

Essentially a charter must (1) grant powers and (2) limit powers. The grant of power should give the superpower corporation the right to generate and distribute throughout the Boston-Washington zone and to take by eminent





ANALYSES BASED ON STUDY OF CONDITIONS IN SUPERPOWER ZONE

Top—Energy consumption of load centers in superpower zone. The horizontal distance between graphs is proportional to the distance between projections of the load centers on a straight line between Washington and Boston. Left—Horsepower, value of products and cost of power per wage earner in the United States compared with similar values in Great Britain. Right—Past and estimated future growth of energy consumption in the Superpower Zone.

domain all necessary lands or easements. On the other hand, the corporation should be limited in the purchase or sale of energy to authorized public utilities in the zone. These utilities should have the first right to subscribe for stock in proportion to their energy output.

Mr. Buckland saw no reason why Congress should not grant the power of eminent domain to the corporation which is so fundamental. This can best be obtained in one of four ways:

1. By private charter granted by Congress.

2. Under a general corporation law to be passed by Congress authorizing the incorporation of superpower corporations to operate anywhere in the United States.

3. By an amendment to the federal water-power act extending the authority of the commission to projects involving power houses generating electrical energy by water or other motive power and providing for the incorporation under a federal charter of associations to become licensees.

4. By an amendment to the federal water-power act as above, the licensee to be a corporation organized under the law of one or more states in the Superpower Zone.

Should Congress grant a private charter, it would in all probability be for twenty years, which would be too short a period to admit of proper financing.

While a general corporation law might enlist more sympathy from Congress than a special charter, it would nevertheless be subject to the same limitations.

By a slight change of language in a few places an amendment could easily be made to the federal water-power act. An addition to the act would permit federal corporations to become licensees. There is the disadvantage, however, of the measure of control exercised by the Federal Power Commission. On the other hand, a longer franchise can be obtained this way than in any other, and even at the end of fifty years recapture by the government must be conditional upon payment of net investment plus reasonable severance damages. To Mr. Buckland the amendment of the act to include the superpower project thereunder would be the most feasible way to secure the desired result. He was of the opinion, however, that if the corporation can be organized under the laws of any of the states with the authority under the federal water-power act to operate as desired it would be the easiest and quickest way to accomplish the desired result. From the above it was concluded that the federal water-power act should be amended so as to embrace power houses generating electrical energy by water or other motive power; that a corporation should be organized in one or more of the states within the Superpower Zone wherever the law is most favorable and its power should be limited to wholesaling of electrical energy.

FINANCIAL PHASES

Absolute protection to the vested rights of existing public utility companies, no price regulation, and rates lower than cost to generate by customer companies are considerations which W. S. Barstow, president of W. S. Barstow & Company, emphasized as the bases for any superpower project. The financial plan as outlined by Mr. Barstow has five aspects:

1. The superpower company as a community enterprise should be incorporated with one class of security to be outstanding, and that to be a non-par stock.

2. The Boston-Washington zone should be divided into districts showing how the distribution to the public is now taken care of by existing public service companies. All remaining territory at present unprovided for by an existing company in this zone should be served directly as occasion arises by a new distributing company which shall operate as now under state regulation and which may or may not be formed by the superpower company, but which will bear the same relation to the superpower company as will the present distributing companies.

3. All existing public service companies in the territory, as they become customers of the superpower company, should be entitled to subscribe to non-par stock in the company pro rata, based on demand, load factor or on some other predetermined definite basis. Public service companies may avail themselves of this right to subscribe or not as they may see fit, but in any event should be entitled to become customers of the superpower system, but a company which is not a customer should not become a stockholder. In case any public service company does not become a stockholder in the superpower company, the stock to which it is entitled to subscribe can be offered to the investing public. In case a public service company becomes a stockholder in the superpower company, the purchase of this stock would be authorized by state public service commissions in the same way as they now authorize the extensions to existing station capacity (as this stock represents such extensions), by permitting the issue and sale of the local public service company's securities, the proceeds from which would be used to acquire the non-par stock at its book value. The basis on which these local public service securities would be issued would, as now, be fixed by the state commission. There are, of course, many companies today that are unable on account of their complicated financial structures to raise capital to enlarge present power plants, and they therefore could not provide a corresponding amount to purchase the equivalent non-par stock of the superpower company. In this case their share in the enterprise would be waived and, as before mentioned, would pass down to the investing public. This should not constitute, however, a waiver of any future rights, as possibly at another time they might be able to take advantage of the superpower investment to improve further their own financial positions.

4. All customer companies subscribing to stock and thus becoming stockholders, as well as any outside interests owning stock, would, as now, elect a board of directors of the superpower company, which board would control the management of the enterprise.

5. A contract, which should be possible of adjustment from time to time to meet the progress of the art, should be entered into between each existing public service company, or public service company to be formed in present unoccupied districts, and the superpower company. Such a contract might in some cases be a selling contract, in some cases a buying contract, or in some cases both buying and selling might be involved, as only by such flexibility can the superpower company take advantage of every economy. The attainment of this company would no doubt necessitate a single dispatching system operated by the superpower company, which might even find it necessary, in order to obtain the results, to control and operate in conjunction with its system the power plants of its customers.

In conclusion Mr. Barstow points out that any economy effected through lower cost of producing energy would, after assurance of a proper market return on the securities of the local company, be passed down to the public. Returns on superpower company stock held by a customer company could, after deducting the proper market return on the securities issued to acquire the stock, go to a special reserve of the customer company and be distributed direct to its security holders; used as a stabilization fund or used for any other purpose not required by the state commission.

Absolute publicity as to earnings, value of stock and cost of physical property of the superpower company are advocated.

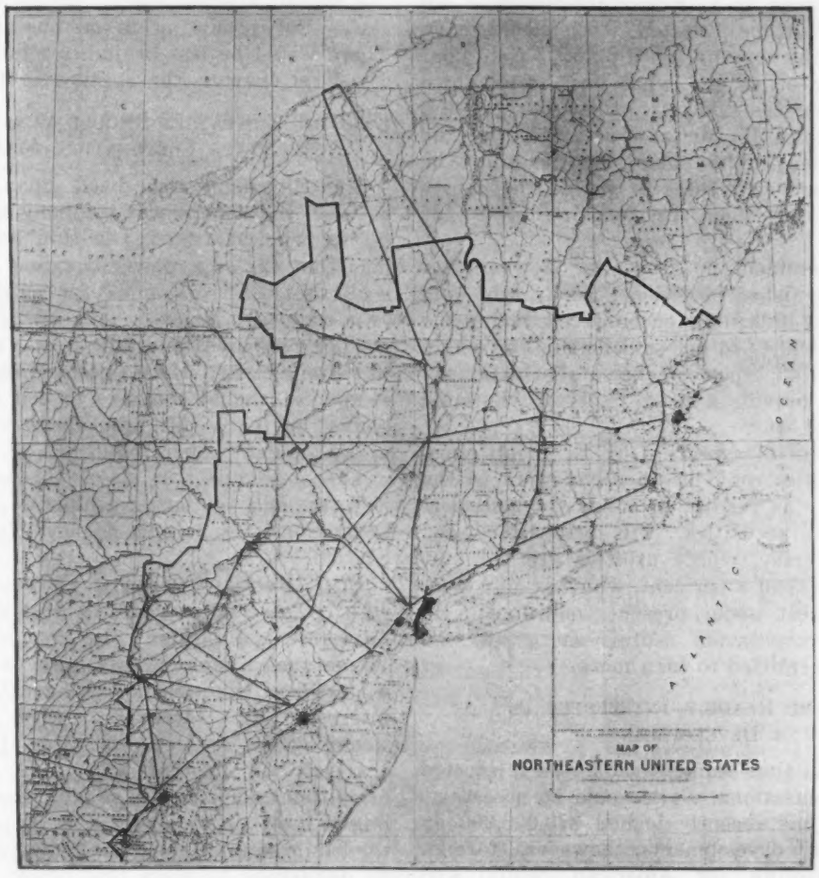
Under the above financial plan Mr. Barstow states

that the company can act as a free agent and take advantage of every economy in obtaining money, materials and labor. Any restrictions which would prevent the free flow of money to the enterprise would, it is stated, at once render it inactive and defeat the attainment of the result shown possible by the survey.

Upon the freedom of action secured through the various states in condemnation for right-of-way, etc., will depend whether or not the company shall have a federal charter. In any event, it is said, there must, in the case of the superpower company, be no price fixing involved, as the government will receive a corresponding benefit in return for any rights it can grant by securing unlimited and economical power for the future development of railroads and industries.

THE PHYSICAL ASPECTS

W. S. Murray in his summary of the physical aspects of the Superpower Survey pointed out that an enormous coal saving could have been effected in the Superpower Zone during 1919 if the facilities which he is advocating for that district had been in existence. The savings would have amounted to 4,300,000 tons for the utilities, 9,566,000 tons for the railroads and 11,000,000 tons for the industries, or a grand total of 24,866,000 tons. If the generation of power continues unco-ordinated, he contended, the annual coal waste will be 50,000,000 tons by 1930, which at $5.35 a ton would represent a monetary loss of $266,500,000. Through the agency of a superpower system two of the most important economies of power production can be satisfied. These would rest, first on the ability to develop hydro-electric power within the zone to maximum capacity, and, second, on the feasibility of establishing 30,000 kw. as the minimum size of generators in the Superpower Zone steam stations.



PRELIMINARY MAP OF SUPERPOWER ZONE IN WHICH INTERCONNECTION OF THE MOST ECONOMICAL PLANTS IS PURPOSED

In making the survey 315 utilities were examined, representing a capacity of 4,000,260 kw., of which 11 per cent was hydraulic and 89 per cent steam. The output of these stations was 10,301,000,000 kw.-hr., hydraulic stations producing 16 per cent of this output and steam stations 84 per cent. The steam stations consumed 11,806,000 tons of coal at a cost of $63,228,000. The average coal rate was 2.73 lb. per kilowatt-hour.

Although the maximum capacity of any steam plant in the territory was 163,000 kw. and that of any hydraulic plant 83,500 kw., the average of all steam plants was found to be 10,000 kw., while the average of hydraulic plants was 2,700 kw. An investment of $598,000,000 is represented by these plants, 85 per cent of the total being for steam plants and 15 per cent for hydraulic.

An analysis of the industries in the Superpower Zone has shown a total of 76,000 plants using 9,000,000 hp. The power requirements of these industries were further divided as shown in the accompanying table.

Exclusive of Niagara Falls and St. Lawrence power, there is available within the zone for water-power development 9,000,000,000 kw.-hr. per annum. However, the utilities, railroads and industries will require 31,000,000,000 kw.-hr. annually by 1930. Allowing for economical application, probably 25 per cent of the power requirements could be supplied by hydro-electric development. To make up the balance it is proposed to use the high efficiency steam plants as a base but retain 75 per cent of the present central-station capacity for peak-load operation. To insure the realization of the full economies of the superpower system the future should see the installation of steam-generating equipment in units of not less than 30,000 kw.

Standardization of 60 cycles as a uniform frequency is recommended, as well as the standardization of plant and railway equipment in so far as that may be possible.

POWER REQUIREMENTS OF INDUSTRIES IN SUPERPOWER ZONE

Kind of Power Used	Horsepower	Approximate Percentages
Steam	5,400,000	60
Gas	300,000	3
Electric	2,800,000	31
Water	500,000	6
Total	9,000,000	100

W. S. Murray estimated that the project would require $100,000,000 each year for the next ten years, but the annual coal saving would be $266,500,000. Of the 5,000,000 kw. capacity in central stations in the zone,

he believed that only 1,000,000 kw. would have to be written off in order to get the benefit of the more efficient superpower stations.

Several important legal difficulties which would have to be overcome were cited by H. I. Harriman in the development of his argument that the superpower company should be organized under a federal charter rather than under a charter granted by any state. He indicated several obstacles to interstate business embodied in laws of several of the New England states. These obstacles he thought could be overcome more readily under a federal charter.

Regarding agreement among utilities which would operate within the zone, C. L. Edgar asserted that ten or twenty men could be selected who should have no difficulty in getting together on a plan. From what was said at this meeting and what had been known previously concerning the difficulty utilities are having to raise money, James H. McGraw asserted that the deduction was obvious: The public utilities must be allowed to charge sufficient rates to get all the money that is necessary for them to keep up with the demands.

An interesting commentary from the viewpoint of the military was furnished by Colonel Kellar, who said that one of the great difficulties encountered during the late war was the inability to get sufficient power where it was needed. The superpower scheme should remedy this deficiency and provide a most important national insurance in time of war.

In discussing financial aspects, Guy E. Tripp questioned whether utilities could use non-par stock of the superpower company as readily as bonds for collateral in issuing their own securities. Mr. Tripp also cited the case of New Jersey, where utilities are not permitted to earn more than 8 per cent, which is only sufficient to cover interest under present conditions. He suggested that a corporation selling energy to the utilities might be permitted to earn more.

Bankers Are Readily Interested in Power Development

A. J. Sheldon said that bankers should be interested readily, but some educational work would be necessary. His own company had recently loaned $70,000,000 on Swiss hydro-electric developments, however, foreign countries are competing for American capital and recently bankers have been allowed 5 per cent commission on loans bearing 8 per cent. One reason for dearer money was that it is coming in smaller quantities, the rich man having been eliminated as an investor in these bonds on account of the income tax.

In answer to E. G. Buckland, who asked how much less than $100,000,000 per year would be required by the separate utilities to take care of increasing business without the superpower company, W. S. Murray said that more money would be required for construction by individual companies than would be necessary for the superpower system.

Mr. Edgar agreed with Mr. Murray that there was nothing in the superpower proposition that has not already been done. What has already been done over 600 miles will be applied to over 30,000 miles. The educational value of Mr. Murray's report should be great, he said.

H. I. Harriman spoke at length on legal aspects of the undertaking and expressed the belief that it would be wise for the larger companies to be the initial organizers of the superpower business of a given district. In developing his point that the federal charter is to be preferred, he pointed to the case of Massachusetts, where corporations doing business within the state must be incorporated under the laws of Massachusetts.

According to the state law of Maine no energy from water power within that state may be exported to other states. In Connecticut it is unlawful to import water-power energy. In Massachusetts corporations cannot have bonds exceeding the par value of capital stock, a provision which greatly handicaps the sale of securities. There would thus be serious difficulties in the way of a superpower corporation organized in one state and attempting to do business in other states. There would be less prejudice against a company with a federal charter, the speaker contended.

Existing Companies Should Purchase Energy From Superpower Corporation to Avoid Conflict

Mr. Harriman also dwelt upon a possible conflict between the superpower company and other companies selling wholesale energy within a given district. He held that the superpower company should not compete with the local companies for existing business. His own company, he said, sells energy to forty or fifty smaller companies and thus does a superpower business in a limited way. He suggested that the existing larger companies should continue to sell to the smaller companies, buying in turn from the superpower corporation, always under proper regulation as to rates.

This procedure was also favored by Mr. Edgar, who held that only the larger companies could afford to build substations for taking energy from the Superpower System.

E. G. Buckland asked if Congress did not have the right to give a franchise to a corporation to carry on interstate and foreign commerce in any of the states. Where such commerce was to be carried on contrary to a state law business may be greatly impeded by local interests, Mr. Harriman replied; but he felt there would be far greater difficulties if the company were chartered in another state. If the company were organized under a state charter, for instance, the state might limit dividends to 5 or 6 per cent and control the business throughout the Superpower Zone. It would be dangerous to place this power in any but federal hands, he believed.

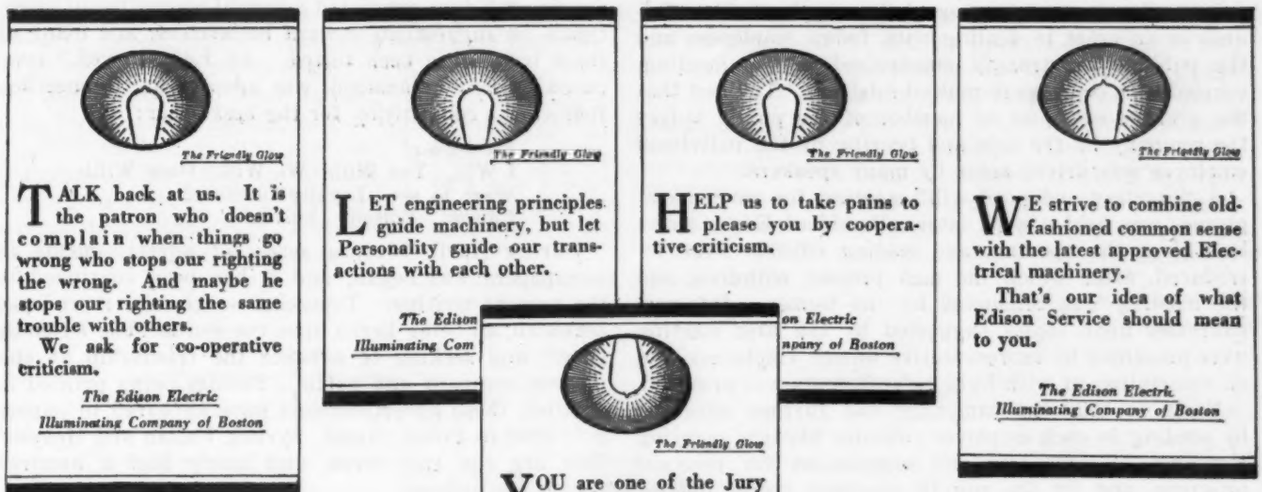
How the "Man in the Street" Is Affected

Regarding the educational value of the project, James H. McGraw said that the superpower plan should appeal to the "man in the street" because the results can be demonstrated. Professor Breckenridge pointed out that the wage earner in this country uses two and a half to three and a half times as much power as the wage earner in Europe—another strong appeal to "the man in the street."

Mr. Tripp agreed with other speakers that representatives of the principal central-station interests within the zone should get together and formulate their ideas beforehand. Dr. George Otis Smith said that the project should not be owned or operated by the government and called attention to the conservation by the project of financial as well as physical resources. He also said that unless a definite legislative and financial plan is submitted the newspapers will formulate one themselves.

Organizing Courtesy to Build Good Will

The Story of How the Boston Edison Company Put Personality Into Its Business, Built Good Will and by Education Made the First Thought of Employees that of Service to the Customers and to the Public


The Friendly Glow
TALK back at us. It is the patron who doesn't complain when things go wrong who stops our righting the wrong. And maybe he stops our righting the same trouble with others.
We ask for co-operative criticism.
The Edison Electric Illuminating Company of Boston
The Friendly Glow
LET engineering principles guide machinery, but let Personality guide our transactions with each other.
The Edison Illuminating Com
The Friendly Glow
HELP us to take pains to please you by cooperative criticism.
on Electric npany of Boston
The Friendly Glow
YOU are one of the Jury that must give a verdict on our actions every hour of the day and year, because our Service covers every ticking second.
It takes sincere and unremitting effort to give such a Service.
We can only do our best if you tell us when our Service displeases you.
The Edison Electric Illuminating Company of Boston
The Friendly Glow
WE strive to combine old-fashioned common sense with the latest approved Electrical machinery.
That's our idea of what Edison Service should mean to you.
The Edison Electric Illuminating Company of Boston

EXAMPLES OF THE FRIENDLY GLOW SERIES

IMPERSONALITY in corporations is believed by the management of the Edison Electric Illuminating Company of Boston to be one of the chief obstacles to an understanding of public utility service ideals and policies by employees and by the public. For many years President C. L. Edgar and his associates have been building up an enviable reputation for this largest of New England central stations in the great territory reached by its lines. Notwithstanding the excellent relations existing within the company and between it and its customers, it was felt soon after the war ended that an even closer friendship might still be realized throughout the system by uniting employees and public in a "good will and courtesy" movement.

The campaign, now more than a year old, was begun in December, 1919, following a program originated and supervised by Converse D. Marsh of New York, and carried out by the company with the co-operation of officers and employees, the advertising department and the company's publication, *Edison Life*, sharing a large part of the work. It is not possible, of course, accurately to measure the results of the campaign; but an indication of these is afforded by a recent telephonic "approach test" of officers and other employees, described further on, which disclosed virtually 100 per cent efficiency in dealing with the public. More than 2,000 employees and more than 100,000 customers, to say nothing of the outside public, are benefiting from the campaign.

All male employees of the company were invited by President Edgar to a mass meeting at the company's Service Buildings, held Dec. 8, 1919. In a letter to each he pointed out that, although he once knew all the customers himself, no single man can know thousands of customers personally, and therefore the employees must take his place in that respect. Expressing the hope that the company, no longer just a business, but a representative institution of New England, will ever remain human and not grow into a mere, huge machine, Mr. Edgar pleaded for the retention of a personality for the company, saying:

> Every day you meet our friends—customers or possible customers. As they find you, smiling or grim, so they will judge us all as a body. To them you are the company—good or bad.
>
> As we grow greater in size, it has seemed to me that we should try to grow greater in spirit—in patience, in courtesy, in true politeness. If all of us give this kind of service, in the right spirit, we have all a better chance to advance as the company itself advances and grows.

This meeting launched the campaign. It was attended by about 1,500 men employees, coming from all over eastern Massachusetts and representing nearly 100 per cent of the male forces of the company. As each man entered he received a program, a song sheet and a "courtesy button" which has become a permanent emblem of the service. Music was furnished by the Edison employees' band. Introduction cards, tobacco and a song, "Pals," written specially for the occasion by J. J. Caddigan, assistant superintendent of the advertising department, and "Chick" Story, were supplied each man. The program included addresses by President Edgar, J. W. Cowles, superintendent installations department; G. C. MacNeill, division head, northern district, maintenance of lines department; C. H. Crockett, assistant purchasing agent; C. A. O'Brien, stock dispatcher, supply department; W. L. Kenney, traffic clerk, transportation department; G. E. Seabury, superintendent station engineering department; W. D. Dyer, assistant superintendent collections department; F. D. Stiles, installa-

tions department, and L. R. Wallis, superintendent sales department. L. D. Gibbs, superintendent advertising department, presided at the main meeting, and John Campbell, superintendent special service department, led an overflow meeting. Among the topics discussed were "Meeting the Public," "You Are the Company," "Good Will from the Buyer's Viewpoint," "Appreciation of Courtesy," "Opportunities," and "The Man I Want to Know." Entertainment furnished by employees and by a vaudeville troupe interspersed the speeches. Cheerfulness as an asset in dealing with fellow employees and the public was strongly emphasized at the meeting, coupled with courtesy in mutual relations. The fact that the average customer or member of the public judges the company by the acts and bearing of the individual employee was driven home by many speakers.

A "courtesy and good will" meeting for women employees was held a week later. President Edgar spoke briefly at the opening, and leading officials were introduced, after which the men present withdrew and the meeting was conducted by the women. Informal addresses upon topics suggested by the first meeting were presented by representative women employees, and an entertainment with light refreshments was provided.

Early in 1920 the campaign was further advanced by sending to each employee calendar blotters carrying messages of good will and suggestions for personal progress, and by the use in company stores, offices, etc., of 11-in. x 17-in. window cards and bulletins conveying the courtesy note to employees and to the public. Typical window cards read:

"The business of this company is to render service and courtesy to the public."

"You help us build right here at home one of the best electric light companies in the U. S. A."

"Home people have some of their money in this company. We are not a national—just a Greater Boston business. As you help us, so we grow."

"Our ability to merit your good will is a greater asset than our bank account. We solicit criticism."

"Machines only click at you. Men and women can speak a kindly word."

The value of the "smile" in business is constantly preached and practiced in connection with the campaign. Pocket cards were also sent employees bearing a message tied in with the campaign. A typical card read: "Do not tell your troubles to customers—what did you think the last time some one tried it on you?" A booklet entitled "Playing the Game" was also sent employees, and this contained sixteen terse, suggestive rules for winning the game of business, such as:

"The smile wins."

"Life is give and take—fifty-fifty."

"Let the other fellow lose his temper—you stand pat."

"Hard workers find their work easy."

In April all employees of the company and their families were invited to a mass meeting at Mechanics Building, Boston, by President Edgar, with the object of broadening their acquaintance and further developing the campaign idea. More than 3,000 persons attended. An attractive entertainment with inspiriting addresses by L. D. Gibbs, who presided, and by H. W. Moses, superintendent of the employment bureau of the company, were features of the occasion. The practice of courtesy and the work of the employment bureau in many ramifications were discussed, and motion pictures, community singing, refreshments and dancing closed the evening. Before this joint meeting President Edgar sent each employee a letter inclosing proofs of a series of "good will and courtesy" advertisements which the company purposed to run in the Greater Boston papers. Criticisms and suggestions were invited, and the response took the form of 700 letters suggesting changes in methods of work and improvements in wording of advertisements, expressing loyalty to the company, etc. President Edgar appointed a special committee to investigate all suggestions toward betterment, and many of these have since been tested. An Edison "yell," composed by E. S. Mansfield, was adopted at the meeting, following a competition for the best cheer:

E-d-i-s-o-n!
I Will, You Will, We Will, Good Will!
Want to see—Loyalty-Courtesy!
Edison! Edison! Edison!

During April, 1919, a series of advertisements in newspapers was begun, and it has been continued to the present writing. Typical messages are reproduced herewith, all being keyed upon the words "The Friendly Glow" and seeking to enhance the friendship of employees, company and public. Besides being printed in English, these advertisements have appeared in papers published in Polish, Greek, Syrian, Italian and Hebrew. Two are run each week, and nearly half a hundred papers are utilized.

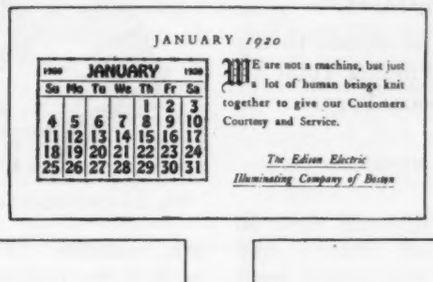
Among the outgrowths of the campaign has been the organization of departmental and bureau meetings in the fall of 1920 for the purpose of carrying forward the co-operative idea along intensive lines within the company; betterment committee work, designed to point out means of improving company practices; educational classes for employees seeking voluntarily to learn about the organization, routine and policies of the company, and conferences of the rank and file, unattended by officials, looking toward improvements in the company's service and methods. The provision of district managerships in the company's territory (see ELECTRICAL WORLD for March 19, page 661) was the outgrowth of a suggestion looking toward betterment in public relations.

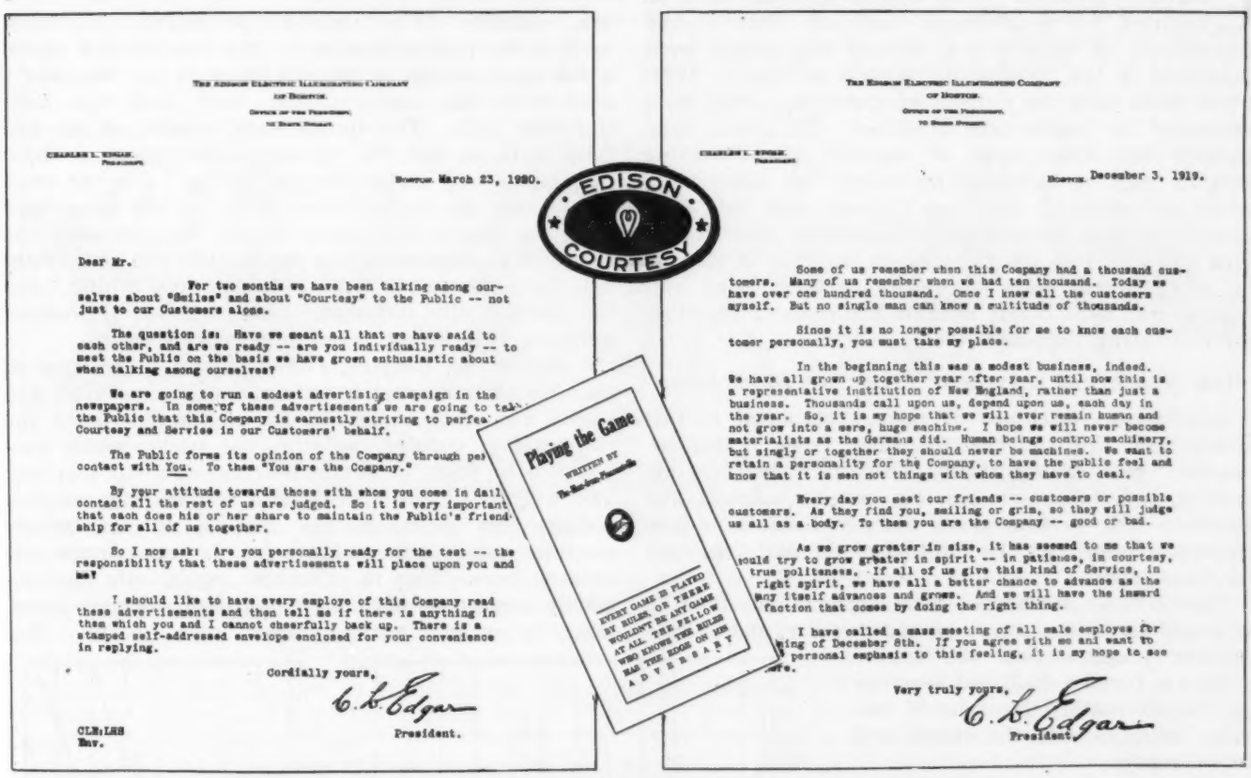
Edison "Approach" Almost Perfect

A remarkable test of the Edison employees' response to the calls of the public was recently conducted by an outsider whose hobby is emphasizing the importance of an old-fashioned politeness. The results of this inquiry, which was made over the telephone and which covered forty-two calls and thirty actual interviews with company representatives, show an almost perfect score. The inquiries were not strictly normal in any case. They noted the quickness of the company's telephone operations, the accuracy with which requests were received and transmitted, the rapidity with which department heads were called to the telephone, results of trying to provoke to irritability the Edison employee who answered the call and of attempting to confuse the hearer by an involved statement with a show of bravado that would have been absent in a personal interview, and they tried to ascertain whether questions quickly "fired" would be answered right off-hand. The excellence of the company's "manners" over the telephone was declared to be remarkable when compared with the indifference met from employees in many industrial enterprises.

All sorts of fictitious situations were brought to the attention of officials and employees from the president

down in this inquiry. "Foolish" questions were asked, imperative demands for the immediate remedying of imaginary troubles were presented, complaints were manufactured about noises in incandescent lamps keeping customers awake, the construction forces were charged with having left poles to encumber private property, pretended delay in service was condemned, and attempts were made to force employees to commit themselves on subjects which they had had no time to investigate. False assertions were made about the behavior of meters, theft of energy by neighbors (address not given) was declared to exist, unjust allegations were made against inspectors, prices of appliances were sought in rapid succession, and fabricated misinformation was utilized by the questioner to attempt to embarrass the employee. In nearly all cases the company's representative asked for the address courteously despite repeated provocation and made every effort to meet the situation with promptness and interest. The results of this unexpected test of the "courtesy factor" of the company were so uniformly good that the management feels a pardonable pride in the attitude of the employees toward the public at large and the customers of this great utility. Several hundred friendly letters and appreciative comments have been received by the company from the public since the beginning of the advertising campaign.


JANUARY 1920
JANUARY
Su Mo Tu We Th Fr Sa
1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
WE are not a machine, but just a lot of human beings knit together to give our Customers Courtesy and Service.
The Edison Electric Illuminating Company of Boston


EDISON
COURTESY
Boston, March 23, 1920.
Dear Mr.
For two months we have been talking among ourselves about "Smiles" and about "Courtesy" to the Public -- not just to our Customers alone.
The question is: Have we meant all that we have said to each other, and are we ready -- are you individually ready -- to meet the Public on the basis we have grown enthusiastic about when talking among ourselves?
We are going to run a modest advertising campaign in the newspapers. In some of these advertisements we are going to tell the Public that this Company is earnestly striving to perfect Courtesy and Service in our Customers' behalf.
The Public forms its opinion of the Company through personal contact with You. To them "You are the Company."
By your attitude towards those with whom you come in daily contact all the rest of us are judged. So it is very important that each does his or her share to maintain the Public's friendship for all of us together.
So I now ask: Are you personally ready for the test -- the responsibility that these advertisements will place upon you and me?
I should like to have every employe of this Company read these advertisements and then tell me if there is anything in them which you and I cannot cheerfully back up. There is a stamped self-addressed envelope enclosed for your convenience in replying.
Cordially yours,
C. L. Edgar
President.
CLE:LHS
Enc.
Playing the Game
WRITTEN BY
EVERY GAME IS PLAYED BY RULES, OR THERE WOULDN'T BE ANY GAME. AT ALL. THE FELLOW WHO KNOWS THE RULES AND THE SOON ON HIS ADVERSARY
Boston, December 3, 1919.
Some of us remember when this Company had a thousand customers. Many of us remember when we had ten thousand. Today we have over one hundred thousand. Once I knew all the customers myself. But no single man can know a multitude of thousands.
Since it is no longer possible for me to know each customer personally, you must take my place.
In the beginning this was a modest business, indeed. We have all grown up together year after year, until now this is a representative institution of New England, rather than just a business. Thousands call upon us, depend upon us, each day in the year. So, it is my hope that we will ever remain human and not grow into a mere, huge machine. I hope we will never become materialists as the Germans did. Human beings control machinery, but singly or together they should never be machines. We want to retain a personality for the Company, to have the public feel and know that it is men not things with whom they have to deal.
Every day you meet our friends -- customers or possible customers. As they find you, smiling or grim, so they will judge us all as a body. To them you are the Company -- good or bad.
As we grow greater in size, it has seemed to me that we should try to grow greater in spirit -- in patience, in courtesy, true politeness. If all of us give this kind of Service, in right spirit, we have all a better chance to advance as the Company itself advances and grows. And we will have the inward satisfaction that comes by doing the right thing.
I have called a mass meeting of all male employes for ... evening of December 8th. If you agree with me and want to ... personal emphasis to this feeling, it is my hope to see ... there.
Very truly yours,
C. L. Edgar
President

MESSAGES TO THE EMPLOYEES, EACH OF WHOM WEARS ONE OF THE COURTESY BUTTONS SHOWN

The ELECTRICAL WORLD is indebted to William H. Atkins, general superintendent of the Boston Edison company, under whose personal oversight the "courtesy and good-will" campaign has been conducted, for much of the information printed in this article. A further article dealing with the interesting incidents of the "approach" campaign will appear in an early issue.

Development of Electricity Supply in Norway and Sweden

THE committee appointed by the Swedish government to work out a uniform plan for the electricity supply of the country has lately reported on the requirements for electrical power in southern Sweden. The committee is of the opinion that at present southern Sweden's need of electrical energy can be met by the utilization of existing water power. The waterfalls of Lagan and Nissan can produce 400,000,000 kw.-hr. and from waterfalls in Blekinge a further 600,000,000 kw.-hr. can be obtained. The increase in demand in the last few years has, however, been so marked that it is expected that in ten years the water-power reserves of southern Sweden will be insufficient and that this section of the country will have to draw on the resources of the northern part, especially the Trollhättan hydro-electric works.

The demand for electrical energy in Norway has grown so much during the last few years that most of the larger towns have been forced to apportion their supply to consumers. This has been the case in Christiania and Bergen, and these two cities have lately been energetically at work to increase their power supply. The municipality of Bergen has acquired the Torfis waterfalls and intends to erect a power plant there without delay. The electricity works of Bergen have recently completed a 50,000-volt transformer plant at the power station of Björlo. A large company, the Bergen Municipal Power Company, has been formed through co-operation of a number of communities for the purpose of the utilization of the waterfalls in the

vicinity of Bergen. The company is equipped with a capital of 9,000,000 crowns, of which 6,000,000 crowns have been subscribed by the municipality of Bergen, which has also made a loan of 20,000,000 crowns to the company.

At the old rate of exchange a Norwegian crown was equivalent to 31 cents.

Data for Estimating Weights of Synchronous Machines

Curves Give Weights of Parts to Be Added to the Necessary Stator and Rotor for Finding Total Weights of Machines of Various Types

By THEO. SCHOU
Chief Engineer the Ideal Electric & Manufacturing Company

COMPLETE curves giving weights of active material required for synchronous machines (motors and generators) of various kva. ratings and speeds were published in the ELECTRICAL WORLD of May 7, 1921. From these data the weights of stator and rotor were estimated for engine-type machines. To obtain total weights for other types of machine, the foregoing weights may be increased by weight for other parts which are given in this issue. From such data it is possible to show how efficiently material is used in each type and also just what saving in material is effected by using higher speeds or units of larger kva. ratings, as well as to obtain weights and costs of machines for estimating purposes.

HOW WEIGHTS OF DIFFERENT TYPES ARE DETERMINED

Synchronous machines of ratings discussed in this article are built in the following types: Engine; bracket; two-bearing, belted, pedestal; two-bearing, coupled, pedestal; three-bearing, belted, pedestal; and vertical. The various types embody the engine-type stator and rotor with the addition of the parts required for these types.

Engine-Type Machines.—This type of machine is arranged for steam, gas or oil engine drive, and as it is common practice with the engine builder to furnish shaft and bearings for the alternator, this type of machine contains only the stator and rotor proper.

Built as synchronous motors, these machines are used mostly for direct-connected drive to air and ammonia compressors. For machine ratings not suited for engine drive one may still speak about the engine-type parts, which, as above stated, consist of the stator and rotor proper only. The weight of the engine-type machine, including frame and rotor spider, to go with the various parts may be estimated very closely from Fig. 2. Here pounds per kva. is plotted to kva. per pole for various back bores (outside diameter of stator punchings. See Fig. 4.)

Bracket-Type Machines.—This type of machine is built largely for high speed with small or moderate kva. capacity. The bracket-type machine contains, besides the engine-type parts, the bracket-type parts, which again consist of two end brackets (or "bonnets") containing the bearings, the shaft and two belt-tightener rails. The approximate weights of bracket-type parts, as per Fig. 3, also include main, or driving, pulley and exciter driving pulley. For the same frame size, or for machines built on the same back bore, the bracket-type parts remain approximately the same. It is understood that the shaft length and weight will vary somewhat with different core widths, and the pulleys with different values, but for estimating purposes this is not taken into consideration.

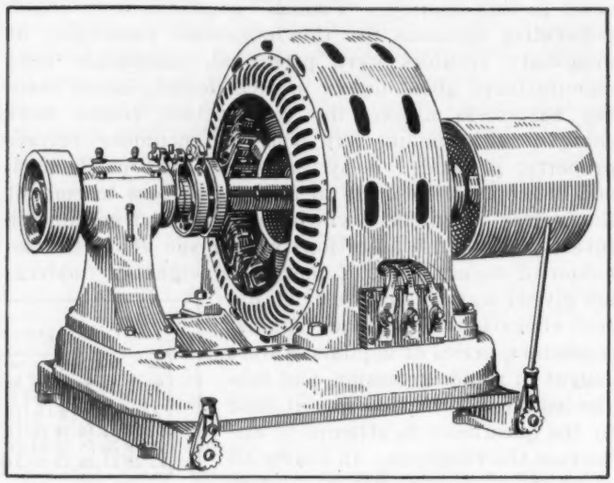


FIG. 1—TWO-BEARING PEDESTAL TYPE FOR BELT CONNECTION

Two-Bearing, Coupled, Pedestal Type.—This type of machine is built over a wide range of capacities and speeds and contains, besides the engine-type parts, the two-bearing, coupled, pedestal-type parts, which consist of base, shaft, pedestals, bearings and half coupling. The weights of the approximate two-bearing, coupled, pedestal-type parts, as per Fig. 3, do not include coupling and remain constant for the same frame size or back bore. This is, of course, again only approximately correct, as both shaft and base will vary somewhat in weight with different core widths. For

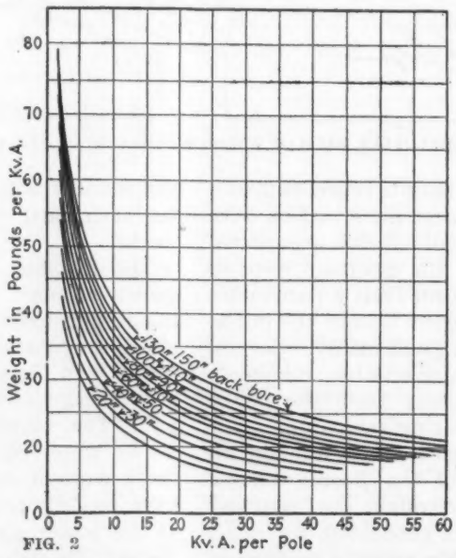


FIG. 2

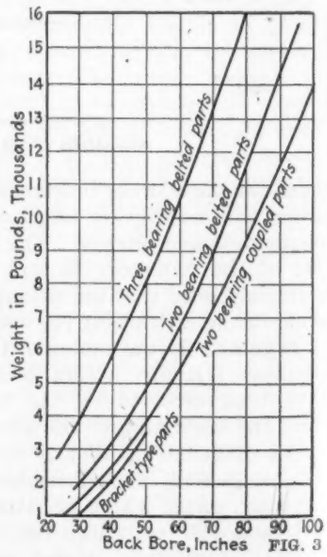


FIG. 3

FIG. 2—NET WEIGHT OF ENGINE-TYPE MACHINES. FIG. 3—WEIGHTS OF PARTS TO BE ADDED TO STATOR AND ROTOR WEIGHTS OF ENGINE-TYPE MACHINES IN ORDER TO OBTAIN APPROXIMATE TOTAL WEIGHT OF ANY TYPE

estimating purposes, however, it will be found that values taken from Fig. 3 give a fair average.

Two-Bearing, Belted, Pedestal Type.—The two-bearing, belted, pedestal-type machine may include ratings built in the bracket type, but also machines of lower speeds and somewhat larger capacities. It will be understood that for the same kva. capacity the back bore increases as the speed decreases, and it will be found that the bracket type is limited, in addition to capacity, by the back bore. This type contains, besides the engine-type parts, the two-bearing, belted, pedestal-type parts, which consist of base, shaft, pedestals, bearings and two belt-tightener rails. No pulleys are included.

Three-Bearing, Belted, Pedestal-Type.—Where the capacity and belt pull limit the application of the two-bearing, belted, pedestal-type machine, the three-bearing, belted, pedestal-type is employed, but this type may also embrace ratings built in the two-bearing, belted, pedestal-type. The weight of the three-bearing, belted, pedestal-type parts, as per Fig. 3, includes shaft, base, three pedestals, three bearings (of which the middle one is usually larger than the two end bearings) and three belt-tightener rails. No pulleys are included.

The vertical type of synchronous machine, arranged for direct connection to vertical waterwheel or pump, may be built over a very wide range of kva. capacities and speeds. Owing to the fact that the construction of the vertical parts varies considerably with the different manufacturers, no attempt has been made in this article to approximate their weight. As to performance, it may be said that because of lower friction the efficiencies of the vertical type are slightly higher than those of the two-bearing types.

The information given in the various curves as to weight of effective and non-effective material will be found to be valuable as to reliable estimates. A few examples demonstrating their use:

Example 1.—It is desired to find the engine-type weight of a machine rated at 250 kva., 200 r.p.m. It will be found that such a machine will be built using a back bore of about 70 in. (178 cm.). The kva. per hole in this instance is 250 ÷ 36, or 6.95. This value corresponds, on a 70-in. back-bore curve, to 38½ lb. (17.46 kg.) per kva. The weight of this engine-type machine is, therefore, 38½ × 250, or 9,600 lb. (4,354 kg.). From curves, Fig. 16 (see ELECTRICAL WORLD, May 7, page 1035), the net weight of effective copper and iron is 4,000 lb. (1,814 kg.). In case of this engine-type machine the "effective" material is 41.6 per cent and the "non-effective" material 58.4 per cent of the total net weight.

To find the total weight of this same machine built as a two-bearing, coupled, pedestal-type machine, we find from Fig. 3 that approximately 7,200 lb. (3,265 kg.) has to be added to the weight of the engine-type parts, or such a machine would weigh approximately 16,800 lb. (7,620 kg.). In this case we find that the "effective" material is 23.8 per cent and the "non-effective" material is 76.2 per cent of the total net weight.

KVA. RATINGS

POLES	R.P.M.	50	100	150	200	300	400	500	600	700	800	900	1000
6	1200	25	to	30	35	to	40	45	to	50	50	to	55
8	900	30	to		35	35	to	45	45	to			55
12	600	30	to	40	40	50	50	to 60	60	to			70
18	400	30	to 40		40	to 50	50	to 60	60	70	70	to	80
24	300	40	to 50		50	to	60	60	to 70	70	to	80	80 to 90
36	200	50	to	60	60	to 70	70	to 80	80	to			90
48	150	70	to	80	80	to 90	90	to 100	100	to			110
72	100	100	to					110	110	to 120	120	to	130
100	72	130	to					140	140	to			150

FIG. 4—DATA FOR DETERMINATION OF APPROXIMATE BACK BORES

Example 2.—It is desired to find the weight of a bracket-type machine rated at 100 kva., 600 r.p.m. The kva. per pole is 100/12, or 8.35. Such a machine will be built on a back bore of approximately 40 in. (100 cm.). From the 40-in. back-bore curve (Fig. 2) we find that 8.35 kva. per pole corresponds to 29½ lb. (13.38 kg.) per kva., or the engine-type part of this machine will weigh approximately 2,900 lb. (1,315 kg.). From Fig. 3 we find that the bracket-type parts for the 40-in. back bore weigh approximately 2,100 lb. (952 kg.). Thus, this machine, built as a bracket type, will weigh approximately 5,000 lb. (2,267 kg.).

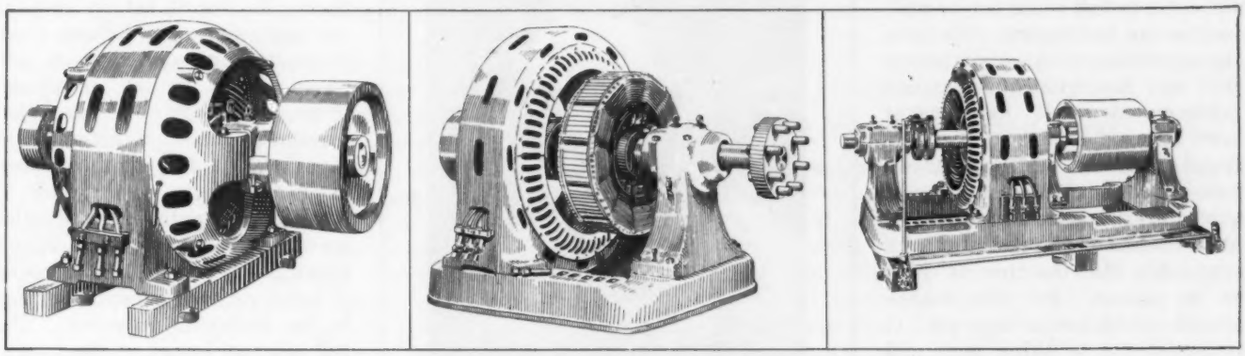


FIG. 5—ASSEMBLY OF SYNCHRONOUS MACHINES INDICATING PARTS REQUIRED FOR TOTAL WEIGHTS
Left—Bracket type. Center—Two-bearing, pedestal, coupled type. Right—Three-bearing, pedestal, belted type.

From Fig. 16 (see ELECTRICAL WORLD, May 7) we find net weight of "effective" iron and copper to be 1,360 lb. (616 kg.). For this bracket-type machine the "effective" material is 27.2 per cent and the "non-effective" material 72.8 per cent of the total net weight.

Example 3.—It is desired to find the weight of a three-bearing, belted, pedestal-type alternator having a capacity of 500 kva., 514 r.p.m. Such a machine would be built on a back bore of approximately 60 in. (150 cm.). The kva. per pole is 500 ÷ 14, or 35.7. From Fig. 2 we find that 35.7 kva. per pole corresponds to approximately 19.2 lb. (8.65 kg.) per kva. on the 60-in. back-bore curve. The engine-type part of this machine weighs, therefore, 19.2 × 500, or 9,600 lb. (4,354 kg.). From Fig. 3 we find that the three-bearing, belted, pedestal-type parts for the 60-in. back bore weigh approximately 10,500 lb. (4,762 kg.). Thus such a machine will weigh 9,600 + 10,500, or 20,100 lb. (9,117 kg.).

For this machine the "effective" material is found to be 23.5 per cent and the "non-effective" material 76.5 per cent of the total net weight.

The Rebirth of the Society for Electrical Development

William L. Goodwin in Charge with Enthusiastic Support of the Directorate—To Carry Out the Broader Aims of the Society—Some of His Plans for a Balanced Economic Service to the Industry

By EARL E. WHITEHORNE

THE reorganization of the Society for Electrical Development under the leadership of William L. Goodwin is good news for every man in the electrical industry. For it is more than a reorganization. That alone might mean nothing more perhaps than an assurance of more activity or more efficiency. What we have here is the rebirth of an idea that we have all believed in and come to feel could not be realized as we had hoped. We have the reopening of an opportunity that may lead to advantages and achievements that have never been enjoyed before in the electrical industry. Moreover, we have here an expression by a group of the selected leaders of all branches of the industry of a confidence that the time is come to go ahead. Its significance should not be lost on any one. It is something to think over and be glad about. It is something that concerns the individual—each central-station-company man and contractor, each manufacturer, jobber and dealer, each engineer and each industrial-plant electrician. I believe that I am not overstating it, for I have talked to Goodwin. I have talked to directors of the society. I am tremendously impressed with the bigness of the purpose and the broadness of the vision that have brought about this awakening of the society.

WILLIAM L. GOODWIN
Reorganizing Society for Electrical Development

A good many years ago—long before the society actually went to work in 1914—the idea began forming in the minds of some of our most forward-thinking men. There has always been a high degree of mutuality of common interest throughout the electrical industry, but a low degree of actual interorganization. Theoretically we have all been electrical men, working together. In reality we have been jobbers or manufacturers or central-station company men or engineers, each a class so intent and busy in its own affairs that there has been no one at leisure and available to do the many kinds of work for all of us that could have been done and can be done to the great benefit of the electrical industry at large.

It was to assume and exercise this function that the society was conceived and instituted. It was to provide a medium through which all classes of electrical men might express and co-ordinate their principles and purposes. It established a common meeting place and set up a machinery for use by all the industry in the working out of conflicting issues between central-station companies, contractors, dealers, jobbers and manufacturers and for the upbuilding of more harmonious and co-operative inter-relations. It aimed to study the needs of all sections and all groups. Its duty was to serve them all. But it set up shop at the beginning of a difficult time. Difficulties of organization and obstacles which developed through the years of war disturbance have interfered in many ways. Its work has been restricted in the past largely to measures of publicity and sales promotion, rendered either broadly in behalf of the industry at large or as a personal service to the individual member. The full original intent of the founders has never been really carried out. The society has never taken its place in the industry. I believe that it is going to do so now.

The men who compose the directorate of the Society for Electrical Development need no introduction to any branch of the electrical industry and no indorsement or defense.

The central stations are represented by John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago; W. W. Freeman, president Union Gas & Electric Company, Cincinnati; Charles L. Edgar, president Edison Electric Illuminating Company of Boston; J. E. Montague, vice-president and general manager of the Niagara Electric Service Corporation, Niagara Falls, N. Y.

The contractors are represented by Frank B. Adam, president Frank Adam Electric Company, St. Louis; George Weiderman, George Weiderman Electric Company, Brooklyn, N. Y.; J. R. Strong, president Tucker Electric Construction Company, New York City; A. Penn Denton, president Denton Engineering & Construction Company, Kansas City, Mo.

The manufacturers are represented by A. W. Burchard, vice-president General Electric Company, New York City; L. A. Osborne, vice-president Westinghouse Electric & Manufacturing Company, New York City; W. D. Steele, vice-president Benjamin Electric Manufacturing

Company, Chicago; L. P. Sawyer, chairman sales group, National Lamp Works, Cleveland, Ohio.

The jobbers are represented by F. D. Van Winkle, Post-Clover Company, Cincinnati; E. W. Rockafellow, general superintendent and sales manager Western Electric Company, New York City; E. C. Graham, president National Electrical Supply Company, Washington; Fred Bissell, president F. Bissell Company, Toledo.

There are also four directors chosen from the industry at large. They are Henry L. Doherty, president Henry L. Doherty Company, New York City; J. Robert Crouse, National Lamp Division, Cleveland; Charles W. Price, president *Electrical Review*, New York City; James H. McGraw, president McGraw-Hill Company, Inc., New York City.

These are the men who are behind the society's new policy of expansion and broader service. These are the men who believe that the time is right to go ahead, who have voiced their confidence that the full purpose of the society can now be achieved and have placed Mr. Goodwin in charge with a free hand to go ahead and do the job. If these men, representing what they do in this great industry of ours, believe that the society can now take up its work and make its promise true, surely the rest of us can trust their judgment and give full, confident support.

Mr. Goodwin himself needs no introduction anywhere in America today to men of the electrical industry. His head first appeared above the skyline of the electrical world when, after making a noteworthy success of a large electrical business enterprise in San Francisco, he accomplished the harmonious organization of the electrical interests of the Coast in a working unity that has been a stimulus to the whole industry. Then he came East, and for the last few years he has been carrying to all parts of the nation with a degree of success that has been enormously helpful and encouraging the gospel of better business methods, broader commercial vision and more effective interorganization for electric men both nationally and locally. He is recognized as the great inspirational leader in the movement for more efficient co-ordination in the industry.

Enlisting the Whole Strength of the Industry

Mr. Goodwin has undertaken the reorganization and guidance of the society with the most enthusiastic support of the men who compose its directorate. But he has made it clear at the outset that he is not going to be content to work alone. Goodwin's conception of the function of the society is exceedingly broad and comprehensive. He believes that the great service to be rendered is an economic one. Sales promotion is but one feature. To enlist the full strength of the industry behind him, therefore, Goodwin has pledged each of his directors individually to a very active personal co-operation, and he means to set the leaders actively to work to help in the many valuable ways in which they can bring aid. He is also planning the appointment of a variety of advisory committees representing the different groups of interests within the industry, so that the different elements in the society's membership may more freely express their needs and opinions and give direction to its activities and service. In this way the society will think and work in more intimate contact, in closer harmony and in truer co-operation with the diverse active influences within the industry than has ever been possible before.

I believe from what I know of the men who have impelled this rebirth of the society and the man to whom has been given its leadership that the S. E. D. is now going ahead in a big way to crystallize and carry out the prime purpose for which such a society, representing all branches of the industry, is needed. Its great field for usefulness, Goodwin says, lies in the direction of economic research and service, and he is right. Rather than deciding itself what its precise policies shall be, it should go into the field and find out what the engineer wants done and what the jobber thinks is needed most.

Each branch of the industry has its needs right now, and its desires, and for most of them there is no machinery available with scope enough to do the job in a broad way that will affect not the central-station company alone, not the manufacturer alone, but the entire field. The industry wants more special knowledge on a hundred points, but more than that it wants this knowledge so disseminated that it will influence not one but all the classes of electrical men according to the economic relationship. Statistics locked up in a strong steel cabinet are no better than so many drawers of empty files, and it is of no use to know what the contractor may want if there is no way to bring into his trade environment the impulse to achieve it. The opportunity for service is enormous, yet I believe that the broad conception which is now to guide the society is big enough to carry the work through.

No Vagueness in the Plans

It is not all vague, however. It is not vague at all. The new, wider vision of the society's function has been well thought out, and there are many definite things which Mr. Goodwin is going to set about and do at once as the new activities can be organized. And they are things like these—I mention only a few of the outstanding plans that Goodwin has outlined to me as things to be done soon:

A school is to be established for bond salesmen, so that they can obtain the background of the electrical industry and be taught to sell electrical securities more eagerly and successfully.

A thrift league is to be started within the electrical industry, not only to encourage saving but to direct the investment of these savings in electrical securities. A responsible finance committee will be organized to give advice.

A legal department will be established to watch the activities of government and state legislation as it affects electrical men. This department will inform the industry as to the drift of legislation in all sections and advise it how to express approval or disapproval or how to adapt itself to the new laws.

An expert statistician will be set to work to develop data and statistics from government, financial, press and other sources and prepare them for actual practical use by the different branches of the industry, interpreted and analyzed for the man who needs them in his business. These statistics will not be merely filed, but sent out for the good that they will do.

The problems of installment selling will be studied and a handbook prepared for the assistance of dealers and central-station companies, backed by a service that will assist all members in the financing of installment contracts by placing them in touch with the market for such paper.

A speakers' bureau will be established on a basis that will enlist a corps of speakers who will be available

whenever an opportunity arises to present the message of the electrical industry to an audience of whatever sort. Thus our story will be more effectively told to chambers of commerce and all the other bodies throughout the country whose interest and appreciation can be made so valuable. Skeleton speeches will be prepared for the personal use of members for any kind of occasion for which an address may be needed.

Regional committees for the guidance of public opinion will be formed among the business men of cities and towns—men who are not in the electrical industry themselves but who appreciate the civic value of electricity and its influence in every industry. These men can and will bring tremendous support if they are so organized.

A correspondence school will be established to provide courses for a broad variety of subjects that will train men for different jobs in all branches of the industry.

A contact will be built up with universities and colleges that will influence the electrical education offered to the young men of this country. The industry needs more than specially educated engineers. It needs trained business men as well, and the society can help toward this.

Careful trade surveys will be made as they are needed for the service of any group in the electrical business, and trade data will be maintained available to members in times of emergency.

A representative of the society will be stationed in Washington to keep in touch with the work of the different government departments, so that the electrical industry may know in detail what is being developed there of value to it and how to utilize the information.

Good-will publicity campaigns will be conducted as needed by the different branches of the industry, and the present service of co-operation with popular magazines and trade journals will be continued and expanded.

The publication of a series of handbooks on various subjects that are not at present adequately supported by printed data is planned, as well as a sensible program of other published selling helps, produced as required.

These are but a few of the ideas around which the reorganization of the Society for Electrical Development is revolving, but they indicate the breadth of the view that is being taken and promise an economic service to the entire industry that will be of actual practical assistance in the day's work to electrical men of every class. At the same time it has been decided to reduce the dues of the society in all classes in accordance with a new scale that in some cases will mean a cut of as much as 50 per cent and to increase its membership so that it shall be truly national in distribution and comprehensive in its character. The basis of reckoning the annual amount of dues will be accurately adjusted, and the finances of the society will unquestionably be greatly strengthened.

In short, we are to have more than a reorganization. It is in truth a rebirth of the big idea, the broad basic conception of the Society for Electrical Development, which all men hailed as good when it was launched seven years ago. In the best judgment of our industry the time is now right to go on and make the dream come true. Mr. Goodwin has been given the job to do, and under his leadership we, the members, have our opportunity at hand. It is our society, and it is up to us to give Goodwin the power in support that will achieve these things he is undertaking.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Development of Bavarian Water Powers

To the Editor of the ELECTRICAL WORLD:

SIR: The Bavarian authorities are making great efforts to develop the water power of the country on a large scale. The big power stations at Walchensee and the Isar have already issued bonds to the amount of 500,000,000 marks in order to be able to meet all demands, and a new company styled the Bavarian Works, capitalized at 100,000,000 marks, is now issuing bonds to the amount of 300,000,000 marks. The chief object is to link up the large hydraulic power stations of the country by high-tension lines with the principal consuming districts. For this purpose a 100,000-volt trunk line will be constructed over a length of about 1,000 km. extending over a large part of Bavaria and the Palatinate.

The cost of construction of the Bavarian Works, including the 100,000-volt transformers, the switch station at Walchensee and the erection of twelve central transformer stations, is estimated at about 450,000,000 marks. It is expected that it will be possible to deliver at least 200,000,000 kw.-hr. per year, which by and by will be raised to 1,000,000,000 kw.-hr. The entire plant is to be ready for work in the autumn of 1923.

HENRY L. GEISSEL.

Beaurivage Thoune, Switzerland.

Load Characteristics of Wired Radio

To the Editor of the ELECTRICAL WORLD:

SIR: In the March, 1921, issue of the *Journal of the Franklin Institute* there appeared a paper under the title of "Guided Wave Telephony," by Prof. Charles A. Culver. In that paper Professor Culver outlines in a very interesting manner the recent progress in this new art and discloses the results of some of his own valuable researches.

In the portion of the paper, however, which deals with the high-frequency characteristics of the line certain statements are made which are not entirely correct and to which exception is hereby taken. Reference is made particularly to the second paragraph, page 317, where it is stated that "One of the first factors which commands one's attention is the fact that in high-frequency work a physical line acts as a lumped capacity." This may or may not be the case. As may be deduced from the theory of transmission lines, and as has been shown experimentally by the writer (*Journal of the Franklin Institute*, Vol. 191, p. 23, January, 1921) a pair of telephone lines of normal spacing or one line with ground return, as the case may be, as an electrical load, will function as an impedance, whose reactive component will have the properties of an inductance or a capacity depending upon the frequency of the impressed emf. If the length of line is such that reflections from the distant end are reduced in amplitude to such an extent that they are inappreciable in their effect when they reach the trans-

mitter, it is quite true that the condition of the terminal apparatus which yields resonance for a particular frequency is not affected by what takes place at the distant terminus. This *effective* length of line is determined by the physical line conditions and by the frequency. For very high frequencies, of the order of 500,000 cycles per second, for which there are a great number of wave developments along the lines, it may be relatively short—*i.e.*, a change in line conditions within a few wave lengths of the terminal apparatus is not felt therein. With decreasing frequency the effective line length increases until at the very low frequencies it will be of the same order as the actual physical length of line.

Under resonant operating conditions, by "tuning of the line," both at the transmitting and receiving terminal, is meant the neutralization of the inductive or capacitative reactance of the line load impedance, together with whatever reactance of either type there is included in the local circuit in series with the line, so that this entire circuit behaves as a resistance at the resonant frequency.

It would appear therefore that Professor Culver's later criticism of General Squier's original findings as to the variation in the load characteristics of the line is unfounded, and that such a variation may exist, indeed should exist.

R. D. DUNCAN,
Washington, D. C. Radio Engineer.

Preservation of Laboratory Mirrors

To the Editor of the ELECTRICAL WORLD:

SIR: About eight years ago the writer contributed to the ELECTRICAL WORLD a little account of the practical use of lacquer in preserving laboratory mirrors silvered on the face. It was found that the highest grade of collodion lacquer used for preserving silvered ware, when diluted with five to seven volumes of the "thinner" provided for it, gave a coating which preserved the integrity of the silver surface against tarnish for a considerable time. The paper referred to may be consulted for the details of the process, to which it may be added that it has been found at the Harvard Observatory, where the process has been in use ever since the writer tried the first coating in 1913, that pure amyl-acetate works rather better than the "thinner" just now obtainable, the dilution being carried to about the same point. It was found in the early experiments that the coating held up for some months for a fairly good reflecting power even in the case of a mirror stored in a damp and dusty cellar.

A few days ago the writer found and took out of his desk a mirror which had been thus silvered very nearly eight years ago, some time in the fall of 1913, and since it looked pretty well it was thought worth while actually to measure the reflection coefficient. This turned out to be 0.70, a remarkable evidence of the practical endurance of the lacquering when kept dry. This particular mirror never had an especially high polish, probably not more than 0.85 when fresh, less probably 4 per cent for the lacquer. The lacquered surface was so tender at this time that brushing off the dust with the softest lens paper produced scratches on the lacquer. Even a camel's-hair brush had to be used with great caution, the surface being almost powdery when touched. It is evident, however, that the lacquering is remarkably durable if the mirror is kept dry and let alone, to prevent abrasion of the surface.

LOUIS BELL,
Boston, Mass. Consulting Engineer.

Making the Partnership Between Utilities and Consumers a Harmonious One

To the Editor of the ELECTRICAL WORLD:

SIR: It is coming to be generally recognized that the consumer of electrical energy is in reality a partner of the electric light and power company. Where proper relations are maintained between the utilities and the consumers the industrial development of the community usually follows, and, on the other hand, it is hardly possible for a community—especially an industrial community—to grow and prosper unless good electric service is one of its assets. Almost every community hopes for ultimate industrial development, and the electric service company affords the means to bring this about. If the utility and the public are in step and proper mutual support is given industrial development is bound to result.

It is unfortunate, then, that this virtual partnership is so often an inharmonious one. At the present time the attitude of the public toward the utilities is in many cases anything but friendly, and the electric light and power company shares in the hostility. The reason is very largely one of dollars and cents. Hard times have come, the people are forced to practice economy again as they did in pre-war times, wages are being reduced, commodity prices are falling, and consumers ask impatiently why power and light bills are not reduced in proportion. The answer, of course, is simple, but multitudes do not know it. They do not understand that while wholesalers and retailers of commodities were able to increase their prices and maintain their profits during the period of inflation and have been as a consequence in a position to reprice their stocks, take their loss and resume their trade on the present market, the utilities, which have been struggling in the last few years against the abnormal price of fuel, labor and materials—most of them failing to make any profit in the period when manufacturers and retailers reaped such harvests—did not get relief until they had carried the burden so long that the increased rates were too late to produce immediate results.

The consumer expects his bills for electrical energy to be reduced at once to the pre-war rates, overlooking the fact that the companies have permanently increased their investment owing to the extended period of high-priced materials and in many cases are still carrying the burden of excessive fuel costs where long-term contracts have been entered into. This is the fact that should be brought home to the consumer. A campaign of publicity which will accomplish this end should be of wonderful help to public service companies. When the facts are explained every fair-minded customer will give the service companies credit for the fight they made to maintain, by efficient operation, a semblance of balance between decreased earnings and the rising production costs in their efforts to avoid the necessity of rate increases. The net results of the efficiency methods practiced in the last two or three years will ultimately benefit every consumer, for when fuel, labor and materials have once more reached normal levels the efficient methods introduced will remain in effect and will play their part in future rate reductions. This result cannot be attained at once, but if the customers can be convinced of the soundness of such reasoning, good public relations—that is, a harmonious partnership—will ensue.

E. B. NEISWANGER,
American Fuel Corporation, President.
Dallas, Tex.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Fire Prevention in Electrical Stations

FIRES due to ordinary causes are entirely unnecessary in buildings devoted to the generation and distribution of electricity. Fires due to the breakdown of the insulation of electrical apparatus and conductors may be kept at a minimum by frequent and thorough inspection and by prompt attention to small repairs and incipient weaknesses.

In the generating plant or substation no large stock of inflammable material should be kept on hand, and there is no excuse for the accumulation of dirt and rubbish in corners and obscure places, nor for gasoline, oil, paint or other specially inflammable substances in lockers and tool closets. Dirty, oil-soaked wiping rags should not be kept, even in an approved waste can. If there are no facilities for washing them, they should be burned as soon as they are unfit for further use. Oil siphoning from transformer leads or dropping from switch cans should be caught in metal cans, and these should be emptied daily. Packing material, paper and the like should be promptly removed from the station and kept in a safe, isolated place or destroyed. Waste cans and containers of other inflammable material should be kept away from electrical apparatus, especially from rotary converters, which are likely to flash over and throw sparks.

All gasoline, with the exception of one gallon in a standard self-closing safety can, should be stored outside. No automobiles or motorcycles should be kept in any of the station buildings under any circumstances.

Slack housekeeping has been the cause of many fires, to say nothing of its detrimental effect upon the apparatus and the service in general and the morale of the operators. A neat, clean station is virtually immune from ordinary fires, and its electrical fires will be few in number and will rarely damage anything outside the apparatus in which the breakdown occurs.

Fire doors must be kept in working order at all times. They are hung on rollers on a slanting track, with a weight and a cotton rope to hold them open, the weight being just enough to keep the door from closing. If there is a fire and the rope burns off, the properly adjusted door will close itself. The best modern practice is to attach the rope to the door with a fusible link of very soft solder. This will melt if the heat becomes great, even though there is no flame present to burn the rope, and the properly adjusted door will close. Wire rope or chain should never be used to hold the weight on a standard fire door. The door should be tested at least once a week. In case a building is left without an attendant, all fire doors should be closed.

Oil should be stored in an outside detached fireproof building. This building should be isolated from inflammable material. Windows, if there are any, should be of wire glass in metal frames. Electric lights should be wired in standard conduit, and no extension cord should be used. In some stations a concrete oil room is built in the station building. A heavy steel door on hinges and with a heavy latch is provided to close the room. This door should be self-closing, and the weight should be suspended with wire rope or chain and kept free of obstructions. Smoking should not be permitted under any circumstances in the oil room nor outside close to its entrance.

Storage batteries are a fire hazard in that they give off an inflammable, explosive gas when charging. Care must be exercised not to use a blowtorch, candle or other open flame in the vicinity of the battery, especially during the charging process. Smoking should not be permitted in the section where the battery is placed.

Consumers' Power Company, Jackson, Mich. — H. J. BURTON.

Periodic Inspection of Services Pays for Itself

TO DETECT the reason for losses either from theft of energy or otherwise at consumers' services, periodic inspection of every service from the pole to the service side of the watt-hour meter is made by some companies.

For these inspections the card shown here was devised by the writer. Every such inspection has disclosed enough theft of energy and defective meter conditions to warrant easily the expense of the inspection. Moreover, the conditions revealed have justified the constant attention of at least one man to follow up the many cases that require careful scrutiny.

SERVICE INSPECTION

Folio No. _____
Address _____ Co. No. _____
Name _____ Cir. No. _____

Light
Power
Classification _____ Heat HP. Conn. _____ No. of Motors _____
Meter Mfg. _____ Type _____ Amps. _____ Volts _____

Dial Primary
Wire _____ Phase _____ Const. _____ Mfg. No. _____ Secondary
Location of Meter _____
Distance from entrance of Bldg. to meter _____ feet
Conduit _____ Open _____ Size of wire _____ B. & S.

No. of circuits in house ____ Is Transformer secondary grounded? _____
Service wires from pole No. ____ Length _____ Size _____
Conditions of wires from entrance to meter _____

Will customer's wiring pass underwriters' inspection? _____
If not, why? _____
Remarks: _____

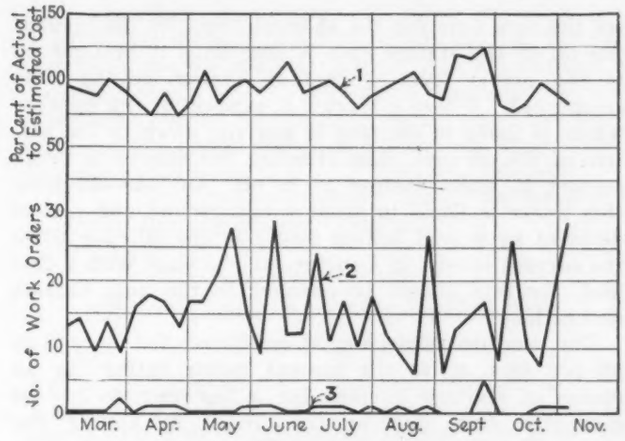
Date _____ Signed _____ Inspector

CONDITION OF SERVICE FROM POLE THROUGH METER RECORDED ON THIS CARD

Henry L. Doherty & Co., New York, N. Y. — THEODORE H. RICE, Operating Department.

Curves Which Help Management in Estimating Cost of Jobs

CURVES which show the variation between the estimated and actual cost of work have proved valuable to the distribution department of the Worcester (Mass.) Electric Light Company. Besides showing the variations above and below 100 per cent in the cost, the chart also shows the number of orders completed per week



MANAGEMENT OF DISTRIBUTION DEPARTMENT IS HELPED BY THESE CURVES, SHOWING VARIATION BETWEEN ESTIMATED AND ACTUAL COSTS

(1) Ratio of actual to estimated cost. (This does not include orders shown by (3), the cost of which fell outside of limits of 50 per cent to 200 per cent of the estimated cost.) (2) Number of work orders completed per week. (3) Number of work orders on which the cost fell outside of the limits of 50 per cent to 200 per cent of the estimated cost.

and the number of jobs for which the cost ran outside of the limits of 50 to 200 per cent of the estimates. The reasons for these variations are usually changes in job requirements. The curves are plotted from the weekly records. They are an excellent check on the accuracy of estimates and a help in making future estimates.

This company uses similar curves for many other purposes. Some of these have already been described in the ELECTRICAL WORLD during the last few weeks and others will be described in future issues.

GEORGE W. HARDY,
Superintendent.

Worcester Electric Light Company,
Worcester, Mass.

Pushing a Large Cable Through a Long Duct

WHILE pulling some cable 3 in. in diameter in the street ducts in Buffalo, N. Y., the cable grip broke several times before the job was completed. Instead of pulling the cable back to the feeding-in manhole, it was pushed the remaining distance through the duct. This was accomplished by rodding a parallel duct and running the pulling rope through this duct. Then a laced side grip was attached to the cable at the feeding-in manhole and the rope was pulled at the other end by means of a winch. This pushed the cable through the duct. In doing this the cable was braced carefully at the side grip to prevent buckling. The grip was attached 1½ ft. from the entrance of the duct, and this length was pulled. Then the grip was changed and a short length was pulled again, and so on. Several cables were pushed through the duct in this manner from 20 ft. to 175 ft. One section of 350,000-circ.mil, three-conductor, lead-jacketed cable about 3 in. in diameter and 440 ft. long, was pushed 175 ft.

To furnish the power for pulling the cable a winch using a Ford engine was employed. This winch was described in the ELECTRICAL WORLD for Jan. 31, 1920, on page 272. The Buffalo General Electric Company has pulled nearly 300,000 ft. of cable with this winch and finds its operation very satisfactory.

WILLIAM HEMPHILL,
Assistant Superintendent of Distribution.

Buffalo General Electric Company,
Buffalo, N. Y.

Compressed Air Proves Its Use in Fishing Through Long Conduit

IN AN installation of street lights in southern California where the runs between outlets was generally 300 ft. and often as much as 450 ft. it was impracticable to use the usual means of fishing the wire through the conduit. Compressed air, however, proved available, and a small air compressor driven by a gasoline engine was used to supply it. This engine was set on a hand truck and employed in connection with a storage tank similar to those commonly found in rural garages. A pneumatic fishing machine was used with a special cord consisting of extra-heavy fish line. In addition to the ease of operation, this method had the advantage that all dirt and foreign matter were blown out of the conduit.

N. B. HINSON,
Engineer of Distribution.

Southern California Edison Company,
Los Angeles, Cal.

System Neutral as Return Decreases Series Lighting Cost

A GROUNDED neutral installed for common use of the 4,000-volt primary and 115/230-volt secondary systems of the Minneapolis General Electric Company is now being used as a return for the direct-current series magnetite street-lighting system in Minneapolis. On the circuits that have been changed over the number of trouble cells has been reduced by 75 per cent, and when all the circuits in the city have been cut over to the grounded neutral system about 250 miles of No. 6 weatherproof wire formerly used as return conductors for the lighting system will be made available for additional lighting or distribution circuits or for other purposes.

Where additional lighting circuits are required the change makes two circuits available where there was one before. For example, one No. 6 duplex 7,500-volt lead-covered underground cable supplied a district 3 miles from the station. When an additional circuit was required the cost of a new cable was saved by using the grounded-neutral system for the return and employing both wires of the duplex cable as outgoing feeders.

With the individual metallic return a ground near the station often caused tree grounds at the distant end of the line, but with the system as now connected the voltage to ground is a minimum at the end of a line where trees usually give the most trouble.

S. B. HOOD,
Superintendent of Distribution.

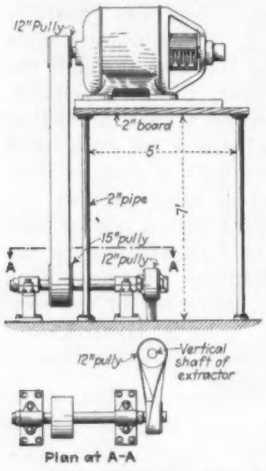
Minneapolis General Electric Company,
Minneapolis, Minn.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Dampness Causes Burned-Out Motor Coils and Belt Slippage

DAMPNESS caused much trouble in the form of belt slippage and burning out of motor coils on an extractor drive in an Eastern textile plant. By raising the motors from the floor and using a larger driving pulley at the floor the trouble was done away with. The motors were rated at 10 hp., 1,200 r.p.m. They were mounted on a concrete foundation on the floor at the base of the extractor, driving with a quarter-turn belt direct to the extractor vertical shaft, with a 7-in. pulley on the motor and a 12-in. pulley on the extractor. The trouble was overcome by erecting a 2-in. pipe framework as shown in the drawing and covering it with 2-in. plank. The motor was placed on the platform and a countershaft erected on hangers on the floor beneath. A 900-r.p.m. motor was substituted for the 1,200-r.p.m. motor, with a 12-in. pulley on the motor driving to a 15-in. pulley on the countershaft and a 12-in. pulley on the countershaft with a quarter-turn belt to the 12-in. pulley on the extractor. No trouble from slippage or burned coils was experienced after the change.



STAND FOR HOLDING MOTOR OFF DAMP FLOOR

Amsterdam, N. Y. ARTHUR R. McDONALD.

Careful Inspection of Compensator Insures Good Operation

A STARTING compensator needs to have careful attention paid to certain parts if it is to be kept operating properly. The inspector should see that the contacts and fingers are in good condition. A starter may make good contact on the starting side and yet fail to connect all the fingers on the running side, owing to one or more of them being burned short. These fingers can sometimes be bent so as to make contact for a short while, but for sure operation new ones should be put in and adjusted so that they will not get caught accidentally.

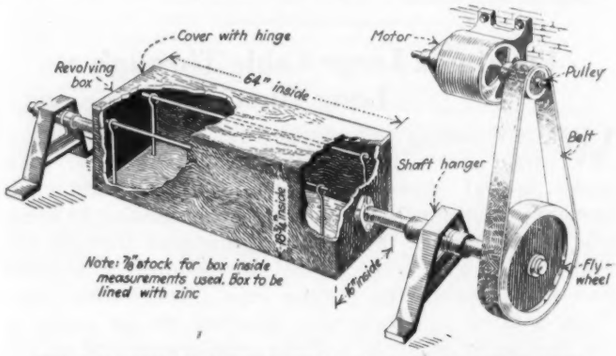
The low-voltage release and the overload relays should be tested frequently, care being taken not to shut down the motor. The adjusting nuts under the core of the relay magnet may have become loosened and have changed their position, thereby allowing the core to lift too high and get wedged tightly. The tripping lever may engage too far at running position and fail to trip when the power goes off. The remedy is to set the core nuts for the shortest trip. If the insulating oil in the starter case is low, have it brought up to the proper level so that all arcing will be fully submerged. Where a starter is exposed to the weather water is liable to get into it and run down to the bottom of the oil case, thus allowing the fingers to break contact in water instead of in oil. On 440-volt lines this water is liable to cause a bad ground and can be detected by a loud boiling sound in the oil case when the current is on. If a motor fails to start with a fair load, the taps should be changed to the next highest connections.

The overload relays should not be set for more than 50 per cent above the normal motor rating, as an excess of starting current for a few seconds can be prevented from opening the circuit by timing the plunger in the relay oil cup. The oil cups under the overload relays often loosen and even drop off. The small set screw which regulates the current limit may become loosened and change the adjustment, which will alter the degree of overload before the circuit opens automatically. H. S. RICH.

East Berlin, Conn.

Revolving Box for Prolonging Life of Edison Cells

OFTEN an old Edison cell which gives a low or a reversed voltage reading may be brought back to normal by shaking it to loosen all detached material from between the plates. For the purpose of shaking such cells a revolving box driven by a motor has been constructed in the battery-repair department of the American Railway Express Company, New York. This box is made of $\frac{7}{8}$-in. wood stock, large enough to accommodate the largest tray used with Edison batteries. On the outside of the ends of the box are flanges holding two shafts which are supported in hangers bolted to the floor. On one of the shafts is a pulley through which the box is driven by a belt from a motor.



BOX FOR TURNING EDISON CELLS TO PROLONG THEIR LIFE

When treating a cell half the solution is poured out, all the cells are placed in a tray which is set inside the

box, and short wooden pieces are laid across the top of the tray. On these are laid two pipes extending the length of the box on each side of the tray. The pipes are inserted in hooks made of ⅝-in. iron and extending through four holes in the bottom of the box. The lower ends of these hooks are threaded to receive large wing-nuts which are screwed tight underneath the box, thus securing the tray firmly in place. The box is then revolved for about ten minutes at a speed of about fifty revolutions per minute.

After this the tray is removed from the box, the electrolyte is poured out and Edison renewal solution is immediately put into the cells. Such treatment will very often wash out and loosen the material which has short-circuited the plates and thus put the old battery back into good condition.

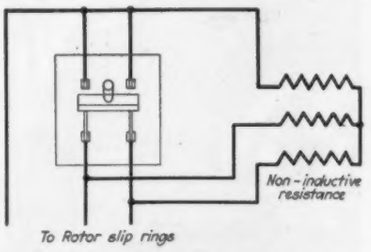
FRED A. REIBERT,
Foreman Battery Repair Department.
American Railway Express Company.
New York, N. Y.

Emergency Starting Switch for Slip-Ring Motor

IN AN emergency, when the usual starting device is not available for a polyphase slip-ring motor, a two-pole switch with an improvised resistor will be entirely satisfactory as a starting device. This would not be recommended for large-size motors, but in sizes up to about 50 hp. would prove useful. The switch and resistor are connected as shown in the figure, the resistor being connected in "star." In an instance in mind the motor was rated at 15 hp., 60 cycles, three-phase, 690 r.p.m. and 440 volts. The nameplate showed that the full-load secondary current was 49 amp. It was also found that the open-circuit voltage between slip rings (rotor stationary, full voltage applied to stator) was 147 volts. This voltage was the average taken on all three phases of the slip rings (from ring to ring) with the leads from the rings to the starter open. The rotor winding was three-phase and connected star.

To obtain an approximate value for the resistance to be inserted in the rotor circuit, the assumption was made that the motor would not be injured by a starting current of two and one-half times the normal full-load current in the rotor circuit.

Using the formula $R = E/(\sqrt{3}\ I)$ = resistance per phase, where E = rotor volts between slip rings and I = rotor amperes at assumed starting value, then $R = 147/(1.73 \times 2.5 \times 49) = 0.69$ ohm. But this includes the resistance of the rotor winding itself, which in this case was approximately 0.09 ohm. Therefore the required starting resistance per phase is 0.6 ohm. The operation of starting the motor when using the emergency starting switch as described is to have the two-pole switch open and then close the primary (or line) switch. This starts the motor with large starting torque. When the motor has reached nearly full speed, the two-pole switch is closed and the motor then operates under normal conditions.



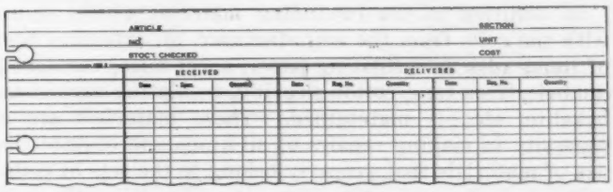
EMERGENCY STARTING ARRANGEMENT FOR A THREE-PHASE SLIP-RING MOTOR

St. Louis, Mo. F. J. B.

Number of Spare Parts to Keep in Stock in Industrial Plant

TO KNOW how large a stock of repair parts to keep on hand for electrical equipment is a problem confronting every industrial plant. Because a special study of this problem has been made through necessity by the New York & Honduras Rosario Mining Company, San Juancito, Honduras, Central America, the methods should be interesting to any plant. This company operates two hydro-electric plants of 700 kva. each—about 1,800 hp. in motors in a 400-ton silver cyaniding plant and two motors of 280 hp. each in a mine compressor plant. There is also an extensive system of electric haulage underground which is subject to rather severe service conditions. The usual time required for materials to reach the mine from the United States is six months from the date of ordering. Under these circumstances it has been found necessary to provide an unusually extensive line of parts and repair materials to take care of any possible emergency and insure continuity of operation and production.

The company maintains a general storeroom in which



SHEET FOR KEEPING TRACK OF SPARE PARTS ON HAND

materials for all departments are kept. All items are entered in ledgers provided for the purpose and are charged out to the departments as used. These ledgers are always available for inspection and afford a ready means of ascertaining at a glance the stock of any given item on hand. A sheet of the ledger is reproduced herewith. Once a year the storeroom provides each department with a list of stock on hand pertaining to that particular department. This serves the double purpose of a check-up and a reminder on items that might have slipped attention during the year. Once a month each department prepares an order based on material used during the month. This order must of necessity anticipate any extensions or improvements for six months and replenish any stock that may be depleted.

One of the principal factors determining the stock of parts to be carried for any particular machine is the importance of that machine in the scheme of production. In a cyanide mill, as in many other processes, the shutdown of a single motor will often cripple the entire plant. A thorough knowledge of the function of each drive is therefore of the first importance. One of the best means of forecasting the future requirements of a machine is an accurate record of its past performance. A record card—which was described by the writer in the ELECTRICAL WORLD of July 24, 1920—is kept for each machine and piece of apparatus. On the reverse side of this card suitable space is provided for recording the operating history. A study of this record, covering a period of years, is of material assistance in determining the repair materials it is advisable to keep on hand for the particular machine.

By far the most important electrical stock maintained is the rewinding coils of all kinds. Skilled labor being unavailable, no coils are wound in the repair shop, sets

and parts of sets, together with the necessary rewinding material, being ordered directly from the manufacturer. Experience has shown that in general the following apportionment of this material has been satisfactory: For the four generators, which represent two different manufacturers, a quarter of a set of each kind is kept. For the mill motors, which are mainly 2,200-volt slip-ring and squirrel-cage induction motors, one set of stator coils is provided for each motor, regardless of the number of motors of the same type and rating, and one set only of rotor coils for each type and rating, regardless of the number of motors of that type and rating. In most cases where there are two or more motors of the same type on important drives a spare motor is provided in addition. A complete set of coils is always on hand for the two large compressor motors. For the six 125-kva. transformers in the mill a spare transformer without the case is always in readiness and a complete set of coils is provided in addition. Twelve 15-kva. transformers are covered by a complete spare and two sets of coils. At the mine substation nine 100-kva. transformers are provided with but one set of coils as the compressor plant can very well operate on six transformers for an indefinite period of time.

In addition to the rewinding material which comes with the coils from the manufacturer, an extensive line of items such as insulating paper, sheet mica, varnished cambric, linen tape, cotton sleeving, insulating varnishes, bakelite, etc., is maintained. These materials are a necessity in making repairs of all kinds and obviate the use of materials that properly belong to the sets of coils.

For motors up to 5 hp. an extra set of bearings is provided in the stock for each motor. For motors above 5 hp. at least one set of each kind is provided, but where there are from two to five motors taking the same bearings a second set is required in stock. Provision is made for rebabbitting all sizes in use. It has been found advisable to have always on hand at least one set of slip rings of each kind in use.

With two power plants and two substations, involving four sets of lightning arresters, a complete renewal of cones and electrolyte for one set of arresters has been found satisfactory. Sufficient transformer oil is always on hand for at least three of the largest transformers.

The stock in items that require regular renewal is maintained entirely on the basis of the records of past requirements. Such items as nozzles, needles and buckets for the waterwheels, brushes, fuses, lamps, batteries, lubricating oils and greases, pinions and pulleys, etc., come under this head. While a considerable stock of such materials as wire of all kinds, insulators, trolley wire and insulators, rail bonds, sockets and wiring devices is maintained, no provision is made for very extensive improvements or extensions, and due notice is always given to the electrical department when anything of the kind is contemplated so that the required material can be ordered in time.

The mine locomotives are subject to more severe service than any of the other electrical machinery operated and consequently require more repairs and renewals. Of the six in use at the present time, two are 4-ton, two 5-ton and two 7-ton machines. Wherever possible the equipment of these locomotives has been standardized. Thus, for example, the controller and trolley-pole equipment on all six locomotives is similar. The stock on all parts subject to regular renewal such as trolley wheels, wheel shafts, bushings and harps, controller fingers and segments, brushes and holders, brake shoes and bearings, is maintained on the basis of past use. While a spare armature is provided for each locomotive, only one set of field coils, one set of wheels and axles, one complete set of resistance grids and one set of brake rods with beam jaw for each of the three sizes is found sufficient. For the four older locomotives an extra commutator and two extra sets of armature coils have proved useful. The newer locomotives, being equipped with interpole motors having ball bearings, are much less subject to breakdown.

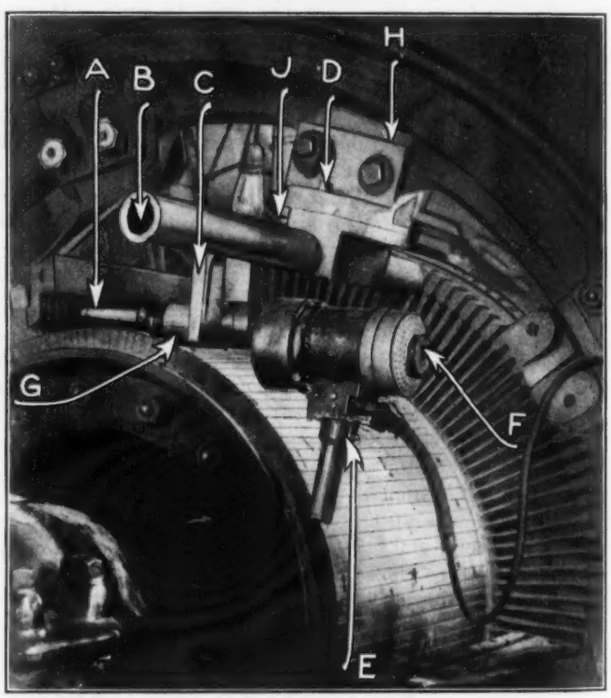
While there are, of course, a great many other items that must be kept in stock, most of those of the first importance have been cited. A thorough study of a given installation, aided wherever possible by records of past performances, will generally enable one to determine the amount of repair materials it is advisable to keep on hand.

FREDERICK KRUG.
New York & Honduras Rosario Mining Company,
San Juancito, Honduras, Central America.

Slotting Machine for Undercutting Mica on Commutators

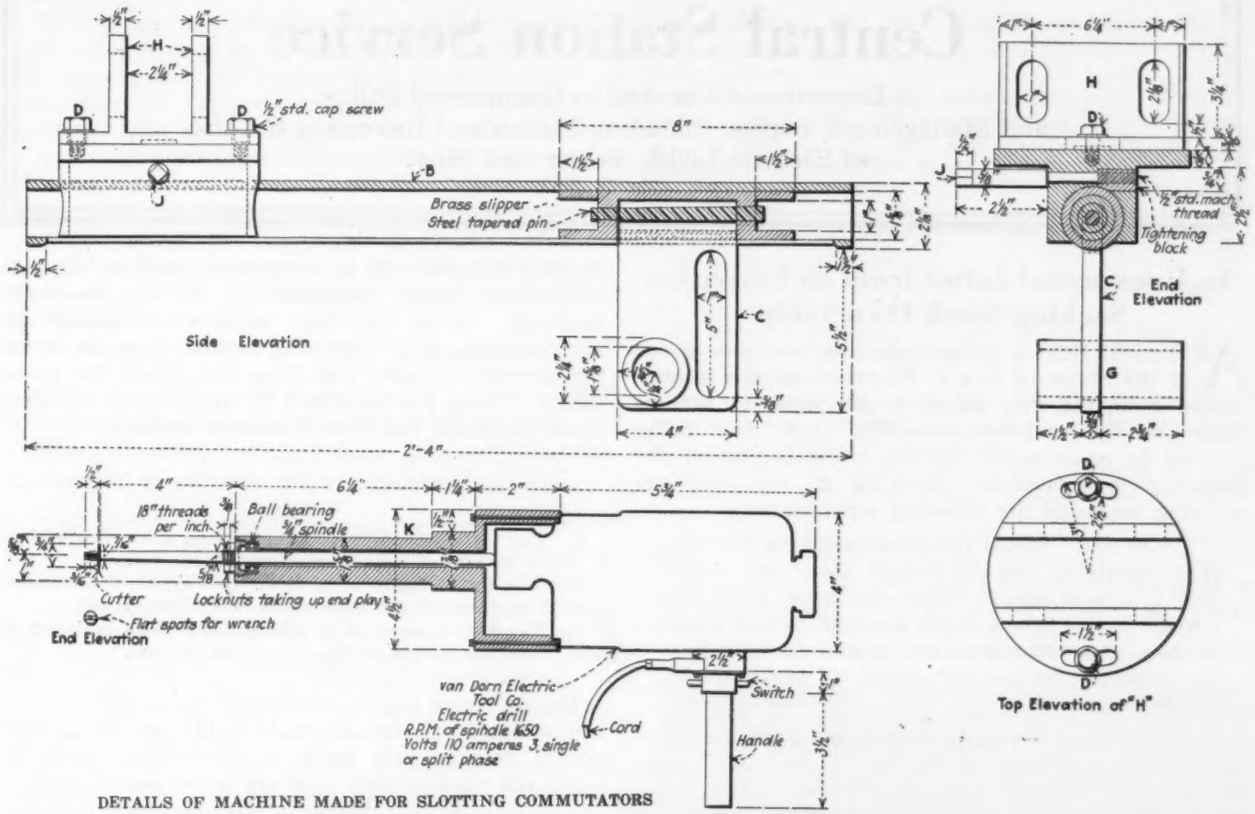
FOR undercutting mica on commutators the mechanical department of a large electrolytic plant in Canada has developed and built an efficient machine. This undercutter is made of an electric drill mounted so as to be movable along the length of the slot and adjustable to be parallel with the slot.

For mounting this machine it is necessary to remove one of the brush arms, in place of which are clamped the jaws *H*. On these clamp pieces is mounted a base plate which may be revolved to bring the cutter in line



TOOL MOUNTED ON BRUSH RINGS FOR SLOTTING COMMUTATOR

with the commutator slot by loosening the cap screw *D* and swinging the hollow steel tube *B* to either the right or the left. This tube is fitted in the base and can be held in any position, depending upon the length of the commutator. This is accomplished with the tightening screw *J*, which draws a tightening block up against the



DETAILS OF MACHINE MADE FOR SLOTTING COMMUTATORS

top of the outside of the steel tube, as shown in the end-view drawing. A cylindrical brass slipper is fitted in this cylinder so that it may slide, and to this is fastened by a tapered steel pin the plate *C*, which passes through a ⅝-in. slot in the tube, permitting this plate *C* to be slid up and down the length of the tube. A sleeve *G* is fitted into this plate for holding the shaft *R*. A long spindle holding the cutting tool is substituted for the chuck of the drill. In order that the cutting tool may be lifted out of the slot and also that the depth of the cut may be varied the shaft is slightly off center with the spindle which drives the cutting tool. Thus when the handle of the drill is rotated in an upward direction the cutting tool is brought down toward the commutator.

For the cutting tool a miller 0.75 in. in diameter and 0.030 in. thick with thirty-two teeth has given the best results. The cutter is driven at approximately 1,650 r.p.m. and should be about 0.0005 in. wider than the mica to remove it completely. The cutting edge should revolve in a direction toward the operator while cutting the mica. In operation the tool is drawn across the face of the commutator by means of the handle in the plate *C*.

It is advisable to have a jet of compressed air so adjusted that the particles of mica and copper will be blown away from the armature to prevent this material falling in behind the commutator and at the same time make it easy for the operator to see the slot when the cutter is throwing particles of copper and mica toward him on the face of the commutator. When a slot has been undercut the cutter can be moved to the next slot, moving the brush yoke by the lead screw or by moving the armature.

When slotting a commutator care should be taken to see that no strips or particles of mica are left flush with the commutator surface. After undercutting it is advisable to run over each slot with a V-shaped commutator file and slightly bevel the edges of the bars to make sure that the slots are free from mica and to remove bars of copper left by the slotting tool.

After the mica is undercut the commutator should be polished with a sandstone of fine grade or sandpaper attached to a block rounded to fit the commutator. The commutator stone is to be preferred, as it leaves the commutator free from scratches. This is important as the brushes to be used on an undercut commutator have no abrasive action and therefore cannot polish out scratches. Lubricants should not be used on undercut commutators, because they will hold carbon dust and other dirt in the slots and may cause short-circuits and resulting burned-out coils.

This undercutter is used on 500-kw., 125-volt direct-current machines. The advantage of undercutting commutators is that brushes which give very little friction

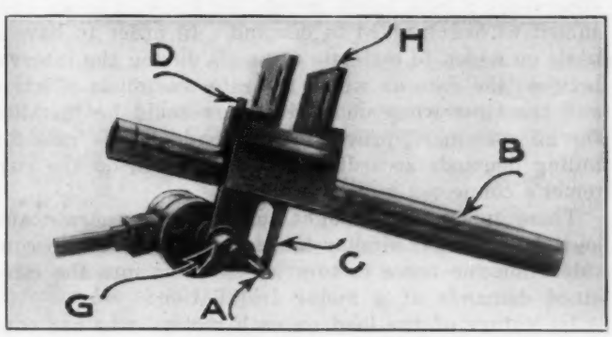


PLATE *C* MAY BE SLID ALONG TUBE *B*

and have no abrasive action on the commutator can be used.

The friction loss with an abrasive brush operated at a pressure of 2 lb. per square inch on an average machine will be about 2.5 per cent of the machine's rating.

Trail, B. C., Canada. R. H. N. LOCKYER.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

An Unexpected Letter from an Employee Seeking Stock Ownership

AN EXPERIENCE of the investment manager of one of the Standard Gas & Electric Company subsidiaries shows the wide appeal to all classes of persons made by the customer-ownership plans now being adopted by many public utilities in raising money for financing improvements. Arriving at his desk one morning, he found the following scrawled note:

> "DEAR SIR: Would you please send me some papers explaining the particulars about the investment? I work here at night—janitress. I feel like I would like to take a couple hundred dollars' worth of stock. You can leave them on your desk for Sunday night as we are not going to work tonight. Oblige. _____"

The investment manager did not leave the literature on his desk as requested, but called personally later. He reported: "I found that the note was written by an old woman who scrubs the floors and works as janitress from 8 p.m. to 6 a.m. In cleaning up my desk she had noticed some of my correspondence and literature and had about decided to transfer her savings account to an investment in our preferred stock. This she has now done and also has arranged for me to make a sale to her son and daughter."

Tables for Estimating Customer's Maximum Demand

BY W. W. ARNETT, JR.

THE Monongahela Valley Traction Company of Fairmont, W. Va., recently put into effect a new power rate for customers having a demand of 25 kva., or over, which includes a charge for the customer's maximum demand measured in kilovolt-amperes and supersedes a rate based merely on kilowatt-hours consumed without regard to demand. In order to have a basis on which to estimate demands during the interval between the date on which the rate was made effective and the time when demand meters could be installed for all customers, provision was made in the rate for billing demands according to tables based on the customer's connected motor load.

These tables are thought to be more accurate and logical than other similar tables, as they take into consideration the three factors which enter into the combined demands of a motor installation:

1. Nature of the load on each motor—whether continuous or intermittent.
2. Diversity factor between the various motors by reason of which the combined demand is less than the sum of the individual demands.
3. Variation of power factor according to the size of induction motor.

The tables are designed to give fifteen-minute time-interval demands and to apply particularly to the coal-mine load, which predominates in the company's territory. From the first table are obtained the kilowatt demands of individual motors, from the second the diversity factor, and from the third the power factor. These are combined in the manner explained below to obtain the kilovolt-ampere demand.

TABLE I—FIFTEEN-MINUTE KW. DEMANDS OF INDIVIDUAL MOTORS

1. The kw. demand of a motor driving a continuous load is taken as 60 per cent of its rated horsepower.
2. The kw. demand of a motor driving an intermittent load is taken as 40 per cent of its rated horsepower.
3. The kw. demand of a mining locomotive is taken as four times the weight of the locomotive in tons.

Motors whose load is continuous for a period of fifteen minutes or more are placed in the first class, while motors driving such loads as coal-cutting machines, hoists and machine-shop tools are in the second class.

TABLE II—DIVERSITY FACTORS

One motor	1.00
Two motors	0.90
Three to five motors	0.85
Six to ten motors	0.80
Eleven or more motors	0.75

TABLE III—POWER FACTOR OF INDUCTION MOTORS

Average size of motors less than 5 hp.	70
Average size of motors 5 hp. to 10 hp.	75
Average size of motors 11 hp. to 25 hp.	80
Average size of motors 26 hp. to 50 hp.	85
Average size of motors over 50 hp.	90

Method of Using Tables

1. Refer to Table I to obtain the kilowatt demand for each motor connected.
2. Multiply the sum of the kilowatt demands obtained from Table I by the proper diversity factor obtained from Table II.

In the case of induction motors:

3. Divide the product so obtained by the proper power factor obtained from Table III. The quotient so obtained will be the kva. demand to be used for billing purposes.

Following is an example showing how the table would be applied to an installation of induction motors:

	Hp.	Kw.
One fan	25 × 0.60	15
One pump	10 × 0.60	6
One hoist	25 × 0.40	10
Two coal-cutting machines	30 × 0.40	24
	120	55

Average size of motors, 120 ÷ 5 ..... 24 hp.
Power-factor ..... 80 per cent
Diversity factor (five motors) ..... 85 per cent
Kva. demand (55 × 0.85) ÷ 0.80 ..... 58.5 kw.

In the case of direct-current motors operating in connection with a motor-generator set of, let us say, 100 hp. capacity the power factor would be taken as 100 per cent if the motor were of the synchronous type, or 90 per cent if the motor were of the induction type.

In applying the tables motors which never operate at the time of peak load should be omitted. For instance, in some mines the coal-cutting machines work at night only, while the peak load occurs during the day. Therefore in computing the total maximum demand of the mine the demand of the cutting machines should not be included.

AVERAGE RESULTS FOUND SATISFACTORY

Since installing demand meters the average results obtained from the tables have been found to check very closely with the metered demands. In some individual cases, however, results obtained by the two methods are found to differ widely.

The use of tables for estimating demands is not to be recommended for customers having a demand of 25 kva. or more, except as an adjunct to the demand-meter method. Customers are continually adding to their connected load, and it is extremely difficult for the power company to keep promptly informed of all motors added. As a result a customer frequently is billed on a basis which is considerably less than his measured demand would have been.

The amount of revenue lost by lack of such information or by the expense of frequent inspection necessary to obtain it would pay for demand meters several times over. Again, customers view the demand tables with suspicion and are much better satisfied to have their demand metered than estimated.

Nebraska Power Company's Inspection Tours Improve Public Relations

AS A PUBLIC-RELATIONS movement the Nebraska Power Company, of which J. E. Davidson, chairman of the Public Relations Section of the National Electric Light Association, is vice-president and general manager, has undertaken a series of inspection tours of its generating station. To date about 2,000 club and civic organization members of Omaha and Council Bluffs, including the Lions, Rotary, Kiwanis and Concord clubs, Electrical Manufacturers and Jobbers' Association, the Advertising-Selling League and the Woman's Club, have been taken through the plant on different days in groups of as many as 250. Competent guides who had been especially trained for the work took them in groups of ten through the station, explaining every important feature of the construction and operation. The principal pieces of equipment were placarded with legends showing what they were and giving costs.

Each trip was made in logical order, starting with the coal storage and bunkers, passing on to the boiler room and through the generating room to the switchboard and outgoing lines. The trips wound up with a lunch served in the boiler room. The food was electrically cooked and music was furnished by the Nebraska Power Company orchestra.

A flashlight picture was taken of each organization, the one shown here having been taken at the luncheon given to the Advertising-Selling League.

When the guests started through the plant a pamphlet was handed to each explaining the important apparatus and equipment and containing the following note of welcome:

To Our Guests:

Because of the "din" it is not possible for me to welcome you as I would wish. The power house is "at your service," and we hope you will make yourselves at home and enjoy our little party. "YOUR ELECTRIC SERVICE COMPANY."

By J. E. DAVIDSON.

SOME FACTS ABOUT THE NEBRASKA POWER COMPANY

We serve 39,000 customers.

Practically every industry in Omaha takes electricity from the Nebraska Power Company.

To generate electricity our plant burns 500 tons of coal a day—an annual consumption of 150,000 tons—a coal bill of a million dollars.

Our plant contains 71,000 hp. in turbine-driven electric generators and includes spare capacity sufficient to guarantee almost uninterrupted service.

"Big Joe," our largest turbine, has a capacity of 27,000 hp. and will take care of two-thirds of the industries of the entire city.

The Nebraska Power Company operates a fleet of thirty motor cars and trucks in maintaining service to customers.

Our service department makes 26,000 calls annually on our customers, to replace their burned out fuses or do other necessary jobs to improve their service.

Our "coal bins" will hold some 20,000 tons, and almost this much is in storage at all times, to insure service regardless of labor or transportation troubles.

ADVERTISING-SELLING LEAGUE LUNCHEON AT NEBRASKA POWER COMPANY'S PLANT

To condense the steam we use in our turbines requires the use of over 100,000,000 gal. of water a day. This is five times the daily consumption of the entire city of Omaha!

There are 33,000 poles installed in the streets and alleys, upon which are carried over 4,000 miles of wire, to carry electric energy to the homes and industries of the city.

The light and power rates of Omaha are very favorable both to residence and power users, as compared with any city in the country, even those with water-power generation.

We have over 1,000,000 regular transactions with our customers each year.

From 1917 to 1921 we have invested over $6,000,000 to meet the demands of growing Omaha.

We have tried to provide "everything electrical" that is either necessary or desirable for your comfort or convenience, and will continue to give you the best service that it is possible for us to supply.

The tours were very popular with the various organizations and gave those attending a better understanding of the meaning of a central-station generating plant. Among other things the *Ad-Sell News* of April 29, 1921, carried an enthusiastic account of the experience of the 450 members of that organization. The affair proved a valuable means of improving public relations, and the Nebraska Power Company feels well repaid for its efforts.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

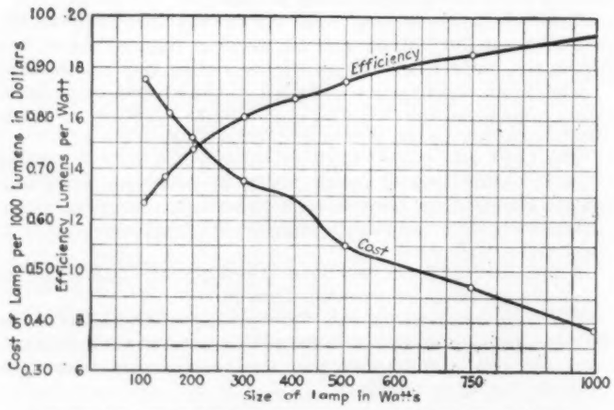
Generators, Motors and Transformers

Calculation of the Mechanical Strength of Large Stators.—H. PISTOYE.—The author determines mathematically the necessary cross-section to be given and the best points of supports of large stators used on generators and motors. As forces causing bending moments the weight of the machine and the asymmetric action of magnetic attraction are considered. The author dwells on the great attention which should be given to the proper design of the main supporting brackets and all the joints in the stator. The article is purely mathematical.—*Revue Générale de l'Electricité*, March 5, 1921.

Auto-Transformers.—R. KORNFELD.—This article deals systematically with all the different possible combinations of auto-transformer connections such as single-phase auto-transformers, three-phase auto-transformers, three-phase to six-phase auto-transformers for converters, and three-phase to two-phase auto-transformers for parallel connection of two-phase and three-phase generators. Properly adapted all the conclusions reached for auto-transformers may be used for ordinary two-winding transformers with taps on one side several of which are loaded at the same time.—*Elektrotechnik und Maschinenbau*, March 6, 1921.

Lamps and Lighting

The Lighting of Piers and Docks.—H. E. MAHAN.—The writer indicates that there is much to be desired in the lighting of piers and docks as practiced at the present time. He points out that suitable lamp units have been available and their installation in progressive industrial plants has demonstrated the material benefits



COST AND EFFICIENCY CURVES FOR GAS-FILLED LAMPS

resulting from adequate illumination. He describes several types of modern lighting units that will economically furnish the intensity and distribution of light necessary for the rapid and efficient performance of work on piers and docks, in warehouses and in large out-door storage areas. The curves reproduced here are of value in considering the cost of producing light. It should be observed that the cost of the light includes the cost of the lamp, the installation and the cost of energy.—*General Electric Review*, April, 1921.

Generation, Transmission and Distribution

Operating Experiences of the Power Supply of Berlin.—E. RÜHLE.—Since 1918 the three main power stations of Berlin have been supplied with additional energy from the large steam plant at Golpa, 130 km. south of Berlin. At present about 40,000 kw. and 800,000 kw.-hr. per day are transmitted from this plant to Berlin at a voltage of 100,000. The proper regulation of the wattless component is very difficult, but is being managed with excellent results. As a compensating device the induction regulator is given preference over any other. In the very near future the general electrification of Germany will bring transmission problems of large magnitude, for which the following rules should be well considered. (1) To achieve highest economy, only part of the required energy should be taken from the transmission line; the remainder should be generated locally. (2) Each power station receiving energy from the trunk line should compensate for its own wattless current. (3) Each power station should regulate its voltage by overexcitation of its machines. (4) No promising results may be obtained from using existing converters for the compensation of the wattless current.—*Elektrische Kraftbetriche und Bahnen*, March 10, 1921.

Power for Victorian Industries.—A series of chapters dealing (1) with the principal power developments in Victoria, giving investment cost and operating cost of three principal generating stations; (2) with the brown-coal deposits used largely in the generation of electricity in Victoria; (3) with electrical apparatus used in the generation and transmission of 132,000 volts, with descriptions of outdoor substations and protective apparatus; (4) with the application of electric power to industry and other like problems showing how they were solved in the Province of Victoria.—*Supplement to Australian Industrial and Mining Standards*, March 17, 1921.

Water Power and Irrigation Projects in Bulgaria.—The results of the investigations carried out by the government of Bulgaria into the resources of that country following the war are summarized as follows: (1) That it is possible to obtain hydro-electric energy to the extent of upward of 1,000,000 hp.; (2) that it would be possible, in addition, to irrigate by means of canals various districts representing a total of nearly 460,000 hectares; (3) that it would be possible to irrigate by means of electrically driven pumps the vast Danubian plains and those of the Deli Orman in North Bulgaria, and (4) that water could be supplied by means of electrically driven pumps to towns and villages which cannot otherwise obtain it.—*London Engineer*, March 25, 1921.

Use of Vegetable Oil as a Power Agent.—Tests were made on English and Dutch engines using both palm oil and cottonseed oil for fuel. Taking these oils as having a calorific value of 8,600 calories, the thermal efficiencies work out to be about 28, 23 and 26 per cent respectively in three cases, as against about 27 per cent with petroleum with a calorific value of 9,600 calories.—London *Electrician*, March 25, 1921.

A Practical Aspect of the Corrosion Problem.—JOHN F. THOMPSON.—This paper lays down the thesis that the use of any metal or alloy is rarely based upon the sole property of resistance to corrosion; that this, although always a necessary factor, is quite frequently not the determining one which governs practical serviceability. This is illustrated by considering various properties which are frequently the determining factors to which resistance to corrosion is secondary, such as hardness, resistance to abrasion and wear, strength at high temperature, tensile strength at low or high temperature, conductivity for heat or electricity, resilience, modulus of elasticity, absence of seasonal cracking, color, avoidance of tarnish, non-sparking property and non-amalgamating characteristics.—From paper presented before American Electrochemical Society, April 21, 1921.

A New Cement for High-Tension Insulators.—WEICKER.—The great difference in the thermal coefficient of thermal expansion between porcelain and cement undoubtedly has something to do with the phenomena of "aging" in cemented insulators. In order to avoid thermal stresses due to the cement the Hermsdorf insulator factory, instead of using pure cement, employs a mixture of cement and a powder of secret composition, which is marketed under the name of "Teleo." The thermal expansion of such cement has been investigated at the German Bureau for Testing Materials, with the following result: Porcelain, 3.5×10^{-6}; "Teleo" cement with 33 per cent cement, 4.0×10^{-6}; ordinary sand cement with 33 per cent cement, 13.0×10^{-6}. Porcelain and "Teleo" cement thus have about the same expansion coefficient, while ordinary cement has an expansion about three times as large.—*Elektrische Kraftbetriebe und Bahnen*, Vol. 18, page 273.

Electrophysics and Magnetism

Wave Propagation Over Parallel Wires; the Proximity Effect.—JOHN R. CARSON.—The mathematical study of wave propagation along a conducting system composed of two similar and equal parallel wires spaced very close together and employing very high frequency. The necessity for this study has been brought about by developments in telephonic transmission such as the carrier-wave system and the utilization of loaded cable circuits in which the wires are very close together.—*Philosophical Magazine*, April, 1921.

Photo-Electric Effect in Audion Bulbs of the Oxide-Coated-Filament Type.—THEODORE W. CASE.—A record of the discovery of photo-electric effects from certain oxide-coated filaments of some high-vacuum Western Electric audion bulbs. Calcium, barium and strontium oxide cells were made, the two last named being principally worked with. The photo-electric current is proportional to the light intensity. The current for average sunlight is 100 to 150 micro-amperes. This is sufficient to run recording ammeters and thus furnish a curve of daylight intensity.—From paper presented before American Electrochemical Society, April 21, 1921.

Recent Modifications in the Construction of Platinum Resistance Thermometers.—T. S. SLIGH.—After a brief résumé of some phases of platinum resistance thermometry a description is given of some recent modifications in the construction of resistance thermometers as regards the heads, leads, terminals and sealing of the strain-free type. Some practical notes regarding the construction of resistance thermometers and a description of the construction of a convenient and effective form of laboratory heating coil are given.—*Scientific Paper No. 407, U. S. Bureau of Standards.*

Telegraphy, Telephony and Signals

Why High Frequency for Radiation?—J. SLEPIAN.—In this discussion the author has attempted to show in a qualitative way how the introduction of Maxwell's displacement currents combined with the previously held laws of electromagnetism explain the fact that electric and magnetic fields are propagated with a finite velocity, and how it is that a rapidly varying current continually gives out energy to space. These displacement currents are required for radiation in space.—*Electric Journal*, April, 1921.

Description of a Uni-Wave Signaling System for Arc Transmitters.—W. A. EATON.—The necessity for the development of a uni-wave or single-wave signaling system is outlined and the essential equipment is discussed.—*Electric Journal*, April, 1921.

Elementary Information for Radio Amateurs.—A list of periodicals and elementary books covering radio information for amateurs. The publication also contains suggestions regarding radio-communication laws and call letters for radio stations in the United States.—*Publication Radio Laboratory, U. S. Bureau of Standards.*

Long-Distance Telephone System of the United Kingdom.—SIR WILLIAM NOBLE.—The writer says that this subject has not been comprehensively dealt with since 1905. At this time, he says, long-distance telephony divides itself along two main lines of development: (1) Communication between the principal commercial centers of the country; (2) communication with remote districts and international communication. The subject is covered in accordance with this outline.—London *Electrician*, March 25 and April 1, 1921.

Carrier Current Telephony and Telegraphy.—E. H. COLPITTS and O. B. BLACKWELL.—This paper briefly outlines the history of the development of carrier multiplex telegraphy and telephony. The fundamental principles underlying particularly the newer developments of the art are then discussed. Consideration is likewise given to the propagation characteristics of open-wire lines, including those containing intermediate lengths of cable. Commercial types of apparatus and actual installations are described and a brief statement is made as to further applications of the art.—*Journal A. I. E. E.*, April and May, 1921.

Digest of United States Patents Relating to Radio Telegraphy and Telephony.—JOHN B. BRADY.—A section of the *Proceedings* of the Institute of Radio Engineers has been set aside for the purpose of making available in convenient form for research engineers and others interested brief information on the radio patents which are granted each week by the Patent Office. Patents covered in this issue are those granted from Jan. 24, 1921, to Feb. 15, 1921.—*Proceedings Institute of Radio Engineers*, April, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by Prof. Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CARBON DIOXIDE RECORDER, ELECTRICAL.

An electrical CO_2 recorder has been devised which does not involve the use of any chemical reaction. Two identical platinum spirals are set in separate cells cut in a copper block and connected to form two arms of a Wheatstone bridge. The flue gas is allowed to come in contact with one spiral, and air is circulated through the cell containing the other. When a fairly large current is passed through the spirals they will heat up and lose heat to the cell walls at a rate directly proportional to the thermal conductivity of the gas in the cell. A difference in cooling rate will allow a difference in temperature between the spirals and will cause a deflection of the galvanometer in the bridge circuit. The difference in conductivity of air and CO_2 will allow the galvanometer to be calibrated directly in per cent carbon dioxide.—*Cambridge and Paul Instrument Company, London, England.*

COLOR MATCH AND SPECTRAL DISTRIBUTION.

When two different radiators, such as a tungsten and a carbon lamp, are color-matched—*i.e.*, adjusted so that the integral color is the same—there has been some question as to the extent to which they have the same distribution of energy in the visible spectrum. Experiments performed with four different radiating bodies—a black body, tungsten, tantalum, and untreated carbon—showed that if these four radiators were color-matched by determining the temperature for which the ratio of the red intensity to the blue intensity was the same then the ratio of the red to the green was not what it should be if they had the same spectral distribution when they were thus color-matched. Taking the black body as the standard the untreated carbon was found to be the same within experimental errors. The ratio of red to green for tungsten differed from that of a black body by about 0.5 per cent for a temperature of about 1,500 deg. K. to about 8 per cent for a temperature of about 2,900 deg. K. For tantalum this difference was very nearly constant for a range in temperature from 1,500 deg. K. to 2,700 deg. K. and was equal to about 6 per cent.—*E. P. Hyde and W. E. Forsythe, Nela Laboratory, Cleveland, Ohio.*

DRY-CELLS, RECORDER FOR TESTING.

Manufacturers and users of dry cells frequently have occasion to test the life of a cell or group of cells under various conditions of discharge. An instrument has been developed that will automatically control the rate of discharge at a predetermined value and at the same time give a continuous record of the variation in terminal voltage, both on open and closed circuit. It is hoped that this instrument may help to develop some new and shorter method of testing dry cells.—*Leeds & Northrup Company, Philadelphia.*

ELECTROLYTIC REPAIRING OF MACHINERY.

A series of tests has been carried out on the repairing by electrolytic deposition of worn-out or too deeply machined steel parts. The best results were obtained from a solution of ferrous ammonium sulphate with a current density of 0.23 amp. per sq.ft. (0.0213 amp. per sq.m.). If iron is deposited on a steel base and the whole annealed to above the A_3 point for pure iron the two will become strongly welded.—*W. A. Macfadyen, London, England.* [N. B.—This method will be found to be a useful adjunct and supplement to the electric welding where the latter is for some reason undesirable.—Editor.]

FLATIRONS, ELECTRIC, TESTING OF.

Plans are under way for the testing of various grades of commercial electric flatirons as to durability, efficiency, etc. The irons to be tested will be submitted by the various manufacturers, and it is planned to test first the 6-lb. size. The results of the test will be published without disclosing the manufacturers' names, but with the idea of indicating to users what figures for durability, efficiency, etc., they can employ in making specifications for their purchases and yet obtain irons of the desired quality. The following tests will be made: General records of weights, size, finish, etc.; consumption at rated voltage, also at maximum and at minimum voltages, for which the flatiron was designed; variation in power consumption on alternating current and direct current and variation with temperature. The temperature of the handle, stand, cord and other parts which have to be handled will be tested at the maximum temperature which the iron will attain; the stability of the irons in various positions will be studied, and durability and efficiency tests will be made of the whole iron and of its various parts.—*N. E. L. A., Division of Standardization and Testing, Washington, D. C.*

SPECTRUM, VISIBLE, OF ACETYLENE FLAME.

A knowledge of the distribution of energy in the visible spectrum of an acetylene flame has become important within the last few years through the use of this flame, in cylindrical form, in investigations of the visibility of radiation. The data on acetylene published by Coblentz form a curve in the visible spectrum which will not agree with that of a black body at any temperature to better than 7 or 8 per cent. As this would mean that no color match could be obtained, a short investigation was undertaken to verify the conclusion and the results gave a curve agreeing within the limits of error with that of a black body at 2,360 deg. K. In the extreme red, beyond 0.70μ, there was indication of a higher emissivity for the acetylene.—*E. P. Hyde, W. E. Forsythe, F. E. Cady, Nela Laboratory, Cleveland.* (N. B.—These preliminary studies to establish reliable standards of radiation lead to methods of measurements of extreme importance in pyrometry and in the improvement of incandescent lamps.)

STEEL FOR PERMANENT MAGNETS.

A new alloy steel possessing an extremely high coercive force and strong residual magnetism has been developed. It contains cobalt, tungsten and chromium. Measurements of the residual magnetism for specimens of slightly different composition gave values from 920 to 620 C. G. S. units, and the coercive force of the same specimens ranged from 226 gauss to 257 gauss. Artificial aging by heating in boiling water and by repeated mechanical shock reduced the residual magnetism by only 6 per cent. Its properties indicate that it is specially suited for short bar magnets.—*Kotaro Honda and Shozo Saito.*

TUNGSTEN, VAPORIZATION OF, EFFECT OF STRONG ELECTROSTATIC FIELDS UPON.

Some preliminary work has been done on the effect of electrostatic fields upon the vaporization of tungsten filaments by noting the change in resistance of a filament with constant current and exposed to an electrostatic field of varying strength which opposed thermionic emission. No effect to within 0.5 per cent was found, but some speculations seem to indicate that by a modification of conditions a positive influence of electrostatic fields on vaporization may be found.—*A. G. Worthing and W. C. Baker, Nela Laboratory, Cleveland.*

Suggestions for Research

ALTERNATORS FOR RADIO SERVICE, SPEED REGULATION OF.

Radio stations using high-frequency alternators require special devices to keep the speed constant in order to have constant-frequency output. Electrical and mechancial regulating devices are held to be unsatisfactory, and some methods of keeping the alternator under constant load have been tried. One method is to use a sending key with a relay which shunts the full alternator output into a ballast circuit when not sending. (See *Elektrotechnische Zeitschrift*, Vol. 41, p. 367, 1920.) A simpler and more effective method of speed regulation is desired.—*Editorial Suggestion.*

CIRCUIT BREAKERS, OIL IMMERSED, RATING OF.

The present method of rating the interrupting capacity of oil circuit breakers is on the basis of a duty cycle, which is intended to be representative of operating practice. However, no single-duty cycle can fully represent very many working conditions, and it is recommended that the ratings of all oil circuit breakers should be made with reference to several duty cycles, and that curves be drawn of the ratings as against the various operating conditions.—*N. E. L. A. Electrical Apparatus Committee.*

POWER PLANTS, COMBINED STEAM AND HYDRO, GOVERNING OF.

There is room for a great deal of original investigation and development in the problem of governing and regulation in combined steam and hydro-electric plants. It has been found difficult to operate such plants in parallel owing to poor frequency regulation of the hydro units. Information is desired as to the best relative regulation or inherent drop of hydro and steam governors under various conditions of water flow.—*N. E. L. A. Prime Movers Committee.*

SYNCHRONOUS MACHINES, HIGH-POTENTIAL TEST.

The present method of applying the high-potential test (A. I. E. E. Standardization Rules) fails to impose any test whatsoever on the insulation within a coil or between adjacent coils of a phase. In the case of a fully connected machine it fails also to impose any test between phase windings where the highest potential exists when the machine is operating. On the other hand, the present test imposes, barring capacity effects, the same stress on the external insulation of all coils. This is quite an unnecessary hardship upon certain parts of the winding, and in a very large machine it produces unknown stresses at certain points, due to capacity effects. Moreover, the present test may impose at some point a stress that is equivalent to exceeding the elastic limit without breakdown, and we have no means of determining the damage done. For these reasons it is suggested that the desired overvoltage be furnished, wherever possible, by the machine itself, running it at a higher excitation and at moderate overspeed, with the armature terminals (a) insulated, (b) grounded on one side. The insulation stress will then be of the same kind as in actual operation.—*W. J. Foster, Schenectady, N. Y.*

TELEPHONE LINES—MITIGATION OF INDUCTIVE INTERFERENCE.

The following arrangement due to Marius Latour has been successfully tried in France: The telephone current is amplified for transmission, and in the terminal apparatus the intensity of this current is brought down to the value corresponding to a normal audition at the same time as the intensity of the disturbing current is reduced. The amplification can be regulated at will at the start, and the disturbances decreased down to a sufficiently low value not to interfere with telephone conversations. The amplifier employed was a vacuum tube with three electrodes. [In view of the importance of the inductive interference problem in this country at the present time this method is well worth trying.—Editor.]

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Wisconsin Municipalities Support State Utility Regulation

WISCONSIN municipalities have given their full support to the regulation of public utilities in the state by the Wisconsin Railroad Commission. This attitude was manifested when the last of the series of bills introduced into the Legislature to abolish the commission was killed by a large majority. The joint committee of the Senate and Assembly which held a public hearing on the bill heard from nearly all the cities in Wisconsin either directly through their mayors, city attorneys and civic associations or through the League of Municipalities. Although utility rates have been increased in nearly all the cities of the state the bill to abolish the commission failed to gain a single supporter among the municipalities represented.

Supply Manufacturers to Meet at New London at End of June

ARRANGEMENTS are being made for the summer section meetings of the Associated Manufacturers of Electrical Supplies, to be held as usual at the Griswold, Eastern Point, New London, Conn., during the week commencing June 27.

One evening will be devoted to a banquet, with special entertainment, music, etc. The newly organized Radio Appliance Section of the association will give a demonstration of the wireless telephone, establishing direct communication with many inland cities and also with ships at sea. The golf course will be open to all and there will be music and dancing every afternoon and evening.

The section meetings will be held at convenient hours during the session, on a schedule to be arranged. The general standards committee will also hold an important meeting during the session. The board of governors will hold its regular June meeting there.

New Financing Totaling $17,000,000 Announced the Past Week

AN UNUSUALLY large volume of new financing, amounting in all to almost $17,000,000, has been announced during the past week. A closed issue of $3,500,000 of twenty-year 8 per cent secured gold bonds of the American Power & Light Company, due May 1, 1941, came out at a price to yield 8.15 per cent. The proceeds will be used to refund $2,200,000 of ten-year notes due in August and for other corporate purposes.

The San Diego Consolidated Gas & Electric Company has disposed of $2,750,000 of first and refunding mortgage 6 per cent gold bonds due March 1, 1939, which are being offered at 87, to yield 7.3 per cent.

A block of $6,000,000 of first and consolidated mortgage series A A 6 per cent gold bonds, due Nov. 1, 1950, of the Niagara Falls Power Company is being offered at 88, to yield about 7 per cent. The proceeds will be used in part in the construction of a new tunnel.

A new issue of $4,500,000 of first lien and refunding mortgage twenty-five-year 7½ per cent series A gold bonds of the Portland (Ore.) Railway, Light & Power Company was brought out a price of 96, to yield 7.85 per cent. An interesting feature of this issue is the provision that it is non-callable during the first ten years.

The Massachusetts Department of Public Utilities has approved the petition of the South Berkshire Power & Electric Company to issue 1,600 additional shares of stock at $110 a share to pay for enlargements.

Georgia Electrical Interests Band Together for Mutual Advantages

REALIZING the need of closer co-operation between the various branches of the industry in Georgia, approximately a hundred of the more prominent men in the electrical business in the state met in Macon on May 9 and 10 for the purpose of organizing a state association the membership of which is to embrace every branch of the electrical industry in Georgia. The movement primarily is the outgrowth of proposed legislation looking toward state condemnation and ownership of all utilities and a bill proposed by the Federation of Trades requiring that licenses shall be issued to electricians doing work in the state only after they have passed examinations.

In order to impress on those in attendance the urgency of the situation a well-planned program had been prepared. Preston S. Arkwright, president of the Georgia Railway & Power Company, in his opening address sounded the keynote of the meeting. Beginning with the infancy of the industry, he sketched its growth to the present time, declaring that in not one single instance can government, state or municipal ownership receive credit for the industry's phenomenal growth. Mr. Arkwright pointed out that should the bills fostered by the Municipal League of Georgia become law the powers granted municipalities under the bill could not be exercised, because the credit situation of the governmental bodies precludes the possibilities of their purchasing the properties from their present owners.

"Money," he said, "cannot be commandeered or coerced. The owners of capital must be coaxed to invest their funds in an enterprise by a feeling of confidence that the borrower will pay a fair price for the use of the money and that it will be returned at the end of the period for which it was borrowed. Threats of confiscation by the state will absolutely prevent the utilities from any further growth or expansion."

In a short but interesting discussion of the present merchandising situation P. C. Gilham, president of the Gilham-Schoen Company, stressed the necessity of more aggressive sales methods by the electrical dealer and

sounded the warning that if the present drift of the business continued, in a very short while the sale of electrical appliances would be squarely in the hands of the hardware, drug and department stores.

W. R. C. Smith of the W. R. C. Smith Publishing Company advocated a broader utilization of newspaper copy as well as direct-by-mail advertising, suggesting in reference to the former class of publicity that dealers pool their advertising funds so that they may dominate considerable space in the local papers.

The addresses of the evening session immediately followed a dinner and a motion picture of the hydro-electric developments of the Georgia Railway & Power Company. The paper by Rawson Collier, general sales manager of the Georgia Railway & Power Company, showed the connection between the state ownership leaders in Georgia and the discredited socialists of Minnesota, quoting from a program of the last meeting of the Municipal Ownership League of America to prove that the radicals were making every effort to enlist organized labor in a nation-wide campaign for government ownership of all utilities and transportation facilities. He also gave some interesting comparisons between the rates of the local utility and those of the Hydro-Electric Commission of Ontario. P. R. Bomeisler, vice-president and general manager of the Ware County Light & Power Company, spoke on the subject of "Co-operation of All the Electrical Interests," declaring that "the public generally and the public utility are one and indivisible, each necessary to the other, growing together and side by side, prosperity for one meaning success to the other and failure for either meaning dire distress to the other." W. E. Trittipo of the Ivanhoe-Regent Works of the General Electric Company made suggestions for better sales methods in the commercial and industrial lighting fields.

The opening of the Tuesday morning session was devoted to addresses by Ralph Walker, president of the Walker Electric & Plumbing Company, and Gadsen Russell, president of the Russell Electric Company, after which the meeting went into business session. The constitution and bylaws, as drawn up by a committee appointed for the purpose, were submitted and adopted. The following officers were elected for the coming year: President, L. W. Roberts, Atlanta; vice-president, G. M. Stout, Atlanta; secretary and treasurer, W. C. Drake, Atlanta; executive committee, Norton Frierson of Savannah, Joel Weir of Athens, P. R. Bomeisler of Waycross, C. S. Banghart of Augusta, Henry Morton of Columbus and Henry Lowe of Macon, Ga.

Irrigation Promoters Oppose Power Project

THE Federal Power Commission as constituted under the new administration was to have its first formal meeting yesterday, May 20. The Secretary of War has had so many demands on his time as hitherto to preclude his presiding at a regular session of the commission. The commission gave a hearing on May 16 on the application of C. E. Loose for a power development on the East Walker River in California, just over the Nevada boundary. Irrigation interests are opposing the project on the ground that the public would benefit more from the development of agriculture than from the 9,000 hp. which Mr. Loose proposes to develop for mining purposes.

Superpower Plants Practicable for Anthracite Regions, Says Murray

DENIAL is made this week by W. S. Murray, chairman of the engineering staff for the Superpower Survey, of the report published in the May 7 issue of the ELECTRICAL WORLD to the effect that mouth-of-mine plants have been found impracticable for superpower plants. This condition holds true for the bituminous fields but not for the anthracite regions, according to Mr. Murray. His statement to the ELECTRICAL WORLD reads:

"As our investigation has progressed it has been very definitely determined that the physical conditions, particularly that relating to a lack of condensing water, prevent the development of electric power in the bituminous-coal mining districts. This, however, is not the case within the anthracite region, since it appears that at Pittston and Sunbury, points on the Susquehanna River, superpower stations, each of 300,000 kw. capacity, can be constructed, to which a third can be added upon the same river about midway between Pittston and Sunbury. The development of these plants will admit of the saving of some 6,000,000 tons of coal annually by the application of their power to anthracite mining, and will provide also, owing to the better diversity factor of the load in this region, as compared with that of the load in the tidewater region, a supply of power in the territory between New York and Philadelphia at a lesser rate of cost than were it generated at these tidewater points."

Public Utility Information Bureau for Texas Advocated

ESTABLISHMENT of a public information bureau by the utilities of Texas was recommended in the address of President Hardgrave at the opening session of the seventeenth annual convention of the Southwestern Electrical and Gas Association at Galveston on Wednesday afternoon. He urged the support of the national publicity campaign by local use of the advertising material and expressed appreciation of the efforts of the manufacturers and jobbers. This appreciation was backed by a resolution of appreciation on the part of the convention. In emphasizing the non-local character of utility service Mr. Hardgrave said that only eighty-four towns with less than 1,000 population in Texas had electric service and added that anything making for uniform regulatory policies over the whole state would enable the spread of electric service to other small communities of this type which are the backbone of trade.

President Insull of the National Electric Light Association described the increased activities of that association. Local ownership of securities was urged by W. B. Tuttle of San Antonio, in reporting for the public policy committee, as a means of bringing about better understanding on the part of the public and customers of utility aims.

Light and power, technical, street railway and commercial section meetings were held Thursday and Friday, and the convention was addressed by W. G. Busby, chairman of the Missouri Public Service Commission, who discussed the subject of state utility commissions. The annual banquet was held Friday evening at the Hotel Galvez.

Indiana Utilities Pay Fourth of State Tax

MORE than one-fourth of the total assessment levied by the Indiana State Board of Tax Commissioners for 1920 was against public utility companies. Figures made public at the State House recently showed that the public utility companies were assessed by the state board for $269,372,564. The total assessments levied by the state board amounted to $969,345,253. Utility companies were assessed for almost three times as much as the total figure for all the banks of Indiana, the total bank assessments being $97,270,475.

F. M. Feiker to Assist Hoover in Plans for Government Aid to Industry

F. M. FEIKER, vice-president and chairman of the editorial board of the McGraw-Hill Company, has been appointed by Herbert Hoover as his personal assistant in the development of the Department of Commerce as an aid to industry. Mr. Hoover has divided the department into two parts, delegating to Assistant Secretary Huston the supervision of the bureaus relating to navigation and fisheries while he himself will devote his attention to the Bureaus of Foreign and Domestic Commerce, Standards and the Census. The problem is to find out from business men what kind of facts and figures industry needs from the government. Once obtained, the problem is to get these facts and figures back to business. It is in this work that Mr. Feiker is most interested. Educated in the engineering profession, his broad executive experience in business publicity makes him particularly fitted to engage in this intelligently conceived plan to make the government serve in a more tangible way American industry.

F. M. FEIKER

Mr. Feiker will be associated with Mr. Hoover while on a leave of absence from the McGraw-Hill Company, of which organization he has been a part since 1915, when he left the A. W. Shaw organization in Chicago to become editor of the ELECTRICAL WORLD. Mr. Feiker was graduated from the Worcester (Mass.) Polytechnic Institute in 1904 in electrical engineering. Except for a year or two in special research work on high-tension transmission, all of his time since graduation has been spent in technical and business journalism. A year was spent as technical journalist for the General Electric Company, and then he joined the staff of *System*. Shortly afterward he developed the idea of *Factory*, a companion magazine, and in 1912 became chairman of the editorial board of all of the Shaw publications.

Upon coming to the ELECTRICAL WORLD in 1915 he quickly sensed the commercial needs of the electrical industry, and the following year with the aid of his associates he launched *Electrical Merchandising* to supplement and extend the service of the ELECTRICAL WORLD to the industry. In January, 1920, his constructive thinking and vision was recognized in his election to the vice-presidency of the McGraw-Hill Company, now engaged in publishing ten other publications in addition to the ELECTRICAL WORLD.

Mr. Feiker has always been sympathetic with the point of view now being expressed so clearly and forcibly by Mr. Hoover. He was unusually active in the formation of the Federation of American Engineering Societies and has always taken a prominent part in the transactions of the many engineering and business societies of which he is a member.

Westinghouse Sales Amount to $151,000,000

SALES billed by the Westinghouse Electric & Manufacturing Company during the year ended March 31, 1921, amounted to $150,980,106.39. The volume of orders booked, it is stated in the annual report made public this week, reached its maximum in August of last year, and, although thereafter somewhat reduced, continued large until December, when there came a sharp drop. The monthly volume of orders since then has remained at about the level reached in December, which was between $8,000,000 and $9,000,000. Shipments continued in large volume, so that on April 1, 1921, the balance of unfilled orders was reduced to $65,621,000.

Property and plant account showed an increase over the previous year of $9,361,403.90. The recession in business, it is stated, will permit a substantial reduction in inventories and notes payable during the ensuing year.

Inventory depreciation and adjustment as of Dec. 31, 1920, at cost or current market value, whichever was lower, was taken care of by including $5,315,196 as a sales cost and appropriating $5,000,000 from surplus for a special contingent reserve to provide for further possible shrinkages and adjustments.

Following is a condensed comparative statement of operations for the past six years:

	Year Ended March 31					
	1921	1920	1919	1918	1917	1916
Gross earnings—sales billed	$150,980,106	$136,052,092	$160,379,943	$95,735,407	$89,539,442	$50,269,240
Cost of sales	138,774,084	120,972,262	144,667,402	80,225,937	72,077,752	40,839,344
Net manufacturing profit	$12,206,022	$15,079,830	$15,712,541	$15,509,470	$17,461,690	$9,429,896
Other income	3,679,464	1,721,334	1,623,262	1,325,263	1,386,547	1,106,730
Gross income from all sources	$15,885,486	$16,801,164	$17,335,803	$16,834,733	$18,848,237	$10,536,626
Interest charges, etc.	3,267,950	1,594,823	2,276,795	1,429,052	768,348	869,837
Net income available for dividends and other purposes	$12,617,536	$15,206,341	$15,059,008	$15,405,681	$18,079,889	$9,666,789

Radio Appliance Section Added to A. M. E. S.

AS AN outcome of the enthusiastic convention and exhibit of radio manufacturers held in New York City the middle of March, a committee of these manufacturers applied for admission to the Associated Manufacturers of Electrical Supplies. Consequently the Radio Appliance Section of the association has been formed with D. R. Murdock of the William J. Murdock Company, Chelsea, Mass., as chairman and George J. Eltz, Jr., Manhattan Electrical Supply Company, New York City, as secretary. A committee has been appointed to recommend the different phases of radio work to cover which permanent committees will be formed.

Kentucky Utilities Hard Hit by Higher Coal Freight

VIRTUALLY every public utility company in the state will be affected by announced increases in freight rates on coal from the mines. The Louisville & Nashville Railroad has reduced rates to Lexington, which were out of line, but put a heavy increase on Louisville and way stations from both the eastern and the western Kentucky mines and on coal moving over its lines from Tennessee and Virginia. On western Kentucky fuel the increase is 15 cents a ton to $1.40, and on eastern Kentucky differentials between steam and prepared coals are removed, resulting in an increase of approximately 33 cents a ton on screenings and 22 cents on mine run.

This will hit the Louisville Gas & Electric Company rather hard on movement of coal from its western Kentucky mines at Echols, Ky., to Louisville, and it along with a number of other large consumers will probably protest against the increase, which is to become effective June 16. Jeffersonville and New Albany, Ind., as well as Cincinnati, are also affected.

Arkansas Utilities Urged to Back National Advertising

A COMBINED correspondence course of study in technical subjects and personal instruction by members of the state university faculty was outlined by Dean Gladson of the Engineering School of the State University of Arkansas in the discussion before the Arkansas Utilities Association at Hot Springs on Thursday of last week of the meter course that the university has undertaken. In addition to the work that is being done with the meter courses in co-operation with the association, Dean Gladson suggested the possibility of working out similar courses in fuel combustion and other subjects.

The local newspaper as an indispensable factor in any advertising campaign was discussed by A. G. Whidden of Pine Bluffs in a talk on "Publicity," in which he made a plea that the newspaper men always be told the facts. If treated with confidence, they can be an important factor in the winning of public confidence, provided that publicity is backed by service and quality. Attention was called to the national advertising campaigns of the National Electric Light Association, and the manufacturers and the utilities were told that these campaigns could not be successful unless they were backed by local advertising. The utility men were urged to be extremely careful of their advertising copy and to avoid the use of advertising space merely for the purpose of placating the editor. Its use was urged only for the purpose of telling a real story that the public is interested in.

The last session on Thursday afternoon was devoted to the subject of electrical merchandising. The principal paper, by C. E. Michel of St. Louis, was to the effect that the contractor-dealer needs less scolding and more encouragement.

The annual banquet was held jointly with the Southwestern Geographic Division of the National Electric Light Association on Friday evening. The following officers were elected: President, R. M. Foster, Helena Water Company, Helena; first vice-president, S. R. Brough, Arkansas Water Company, Little Rock; second vice-president, S. A. Lane, Southwestern Bell Telephone Company, Little Rock; secretary-treasurer, R. I. Brown, Little Rock Railway & Electric Company. The next convention will be held at Little Rock.

Northwest Association Convention to Be Held in June

THE fourteenth annual convention of the Northwest Electric Light and Power Association is to be held in Portland, Ore., June 15 to 18 inclusive. Formerly the conventions were held in September, but it has been decided that June is a better month. The following tentative program has been arranged:

WEDNESDAY, JUNE 15

Morning.—Address of welcome by G. L. Baker, Mayor of Portland; annual address by President Franklin T. Griffith.

Noon.—Luncheon at Portland Ad Club, F. T. Griffith chairman.

Afternoon.—"The National Electric Light Association," by M. H. Aylesworth, executive manager of the N. E. L. A.; report of the executive committee of the Accounting Section, J. S. Simpson; "Accounting," by George Nevins.

THURSDAY, JUNE 16

Morning.—Report of the executive committee of the Commercial Seetion, R. W. Clark; report of the advisory committee of the Northwest Electrical Service League; address by S. I. Miller, secretary-manager of the Northwest Electrical Service League.

Afternoon.—Report of executive committee of the Public Relations Section, W. H. McGrath; "Public Relations," by George L. Meyers; "The Northwest—Its Present and Future in Industry," by Robert Sibley.

Evening.—Addresses by public utility officials and investment bankers.

FRIDAY, JUNE 17

Morning.—"Some Essentials of Power Development," by L. T. Merwin; report of the executive committee of the Technical Section, George E. Quinan.

Afternoon.—Executive session; election of officers.

An extensive program of entertainment has been provided which will include an automobile, boat and inspection tour.

Publicity of Accounts Reduces Number of Rate Cases, Says Commissioner Weed

AN OPEN policy regarding accounts, coupled with adequate returns exhibiting operating facts, is a strong factor in cutting down rate disputes, declared Commissioner A. R. Weed of the Massachusetts Department of Public Utilities before the New England Division of the N. E. L. A., at a luncheon meeting in Springfield, Mass., May 17. Short addresses were

also given by S. W. Damon, president Springfield Fire & Marine Insurance Company; President Adams of the Springfield Chamber of Commerce and J. W. Lester, chief accountant of the Massachusetts commission, who conducted an informal conference upon the new accounting forms to be adopted in Massachusetts probably July 1.

Commissioner Weed emphasized the value of the returns of public utilities to the board and expressed his faith in the integrity of company accounting figures in general. He stated that he does not share the distrust sometimes expressed in regard to such figures and data. An accurate, complete and intelligent accounting is one of the best assets of a company in making for better public relations. Rate cases, with their violent and thoroughly exhausting adjustments, can often be avoided if adequate accounting publicity is practiced. The speaker disclaimed any desire on the part of the regulating commission to enter into company management. He predicted a splendid future for the electrical industry and commended the popularization of investment in sound securities devoted to the upbuilding of public utility service.

Public Relations Are Main Theme of Southwest Section Convention

PUBLIC relations and publicity problems dominated the discussions at the first annual meeting of the Southwestern Geographic Division of the National Electric Light Association at Hot Springs, Ark., on Friday and Saturday of last week. President Hardgrave called attention in his address to the necessity of continued high rates caused by the condition of deferred and current maintenance due to the war and the time lag between the rise in operating costs and rate increases. Utilities were advised to take the offensive and not wait to be placed in a defensive position by the demand from the public for lower rates induced by the decrease in other prices.

C. H. Moses of Little Rock attributed the abolishment of the Arkansas Utility Commission to public misunderstanding of the term "indeterminate" in connection with the franchise situation, state utilities having surrendered franchises given by the municipalities for indeterminate permits under the commission authority. A second factor was the impression that the commission had received authority to abrogate valuable contracts between utilities and municipalities.

President Insull of the National Electric Light Association emphasized the necessity of utilities giving good service as a preliminary to establishing proper public relations.

That action in dealing with public relations must be taken from an offensive and not a defensive position was forcibly asserted by J. H. Gill of Dallas, Tex., in discussing the needs of the industry. The first essential step in bringing understanding to the public is to destroy the conception of the utility business as a commodity business in which the capital is invested in the product sold as in other forms of business.

The essential qualities to be looked for in employees are ability to look forward, ambition, and willingness to take increasing responsibility, according to the view taken by J. F. Owens of Oklahoma City, in discussing "Internal Organization." All the public has a right to know of any employees is that they are company employees, and they should be so educated in company affairs that the information customers are entitled to regarding operations can be given by any employee.

"The most beneficent labor law ever enacted" was the characterization of the statute establishing the Kansas Court of Industrial Relations, made by Judge W. L. Huggins of that court in an enthusiastically received talk upon it. He outlined the foundation of the law in old English law and made a strong plea for the same regulation of labor that capital must face. Twenty-eight cases with a record of no appeals have so far been adjudicated by this court.

President Hardgrave pointed out that the day of the small-town central station is past, and that there is increasing necessity for the larger central stations to feed a number of communities if the service to these communities is to be successfully maintained. The necessity of non-par-value stock laws was urged, and by resolution the convention expressed its intention of undertaking the introduction of the necessary bills into the legislatures of the states included in the section. Mr. Hardgrave also said that the time was rapidly approaching when industries must be established with reference to the location of raw materials rather than at railway centers, owing to the high cost of transportation. This condition indicates the necessity of looking forward to the transmission systems that must be developed to serve potential industrial districts.

DELEGATES TO FIRST ANNUAL MEETING OF SOUTHWESTERN GEOGRAPHIC DIVISION, N.E.L.A.

Parallel meetings of the accounting, commercial, public relations and technical sections were held on Friday afternoon. These meetings revealed that the sections have been organized to fit in with the activities of the similar national sections and are now so functioning.

President Insull of the National Electric Light Association was the speaker at the banquet on Friday eve-

ning. At the Saturday section W. J. Canada, engineer of the national association, told the convention of that association's organization and plans.

The entire list of officers for last year was re-elected for the coming year. A constitution and by-laws were also formally adopted.

Nebraska Commission Powers Not Extended

THE bill before the Nebraska Legislature to give the Railroad Commission full authority over all utilities has been laid on the table indefinitely by the committee to which it was referred. At the election last fall a constitutional amendment permitting the Legislature to place all utilities under commission rule was adopted, but present indications are that it will take at least another legislative session to carry the amendment into effect.

Ontario Hydro-Electric Commission Lowers Rates

RATE reductions in three cities, twenty-one towns and thirty-two villages in the Niagara district of Ontario are, it is authoritatively announced, to be made by the Hydro-Electric Power Commission of that province. Slight increases are to be made in one city and two towns, while the remaining eighty-four municipalities in the district will continue to be served at the former rates. Prices in the city of Toronto are not changed. The commission refused to make the amount of the reductions public pending the dispatch of official notification to the municipalities affected, but it is understood that the cuts are substantial ones. The last price reduction went into effect about a year ago, and since 1912 at least one cut in rates a year has been announced.

Defective Vision Among School Children Due Largely to Poor Lighting

THERE were 141,000 cases of defective vision reported among school children last year in the State of New York. Furthermore, declared Dr. William A. Howe, head of the health department of the New York State Board of Education, in addressing the New York Section of the Illuminating Engineering Society on May 12, a large percentage of the defects of vision are errors of refraction traced very directly to poor lighting conditions. The child is especially susceptible to eye strain at the school age, and from 8 to 15 per cent of all children have their vision impaired by eye strain during the first few years of school. The illuminating engineer can play a very important part in the remedying of the situation.

F. H. Wood, also of the New York Board of Education, who is in charge of buildings, presented some of the difficulties met with in school lighting, particularly those having to do with structural features. He urged the illuminating Engineering Society to evince an active interest in the matter by submitting a statement on artificial lighting to the Board of Education conference this summer.

Although school lighting as a producer of revenue to the engineer may not be particularly attractive, the possibilities of teaching the principles of good lighting are better in the school than any other place, observed G. H. Stickney, Edison Lamp Works, in commenting on school lighting from the standpoint of the illuminating engineer. Quantity of light has been the most difficult problem of school lighting because many school boards have attempted to economize on this point. Although offices and factories are using higher and higher intensities, schools can be found with very low foot-candle values of illumination. Certainly the product of the schools, continued Mr. Stickney, is far more important than the output of an industry.

N. E. Siegel, director of night schools for the city of New York, stated that 2,000 rooms in the city schools were being used for night-school purposes, but that the illumination was poor, in most cases not exceeding 2 to 4 foot-candles.

Secretary Wallace Opposes Proposed Alaskan Development Board

SECRETARY WALLACE of the Department of Agriculture, in a public statement this week, opposed the bill to create an Alaskan Development Board to take over the activities now carried on in Alaska by the Department of Agriculture, the Department of Commerce, the Federal Power Commission and, to a large extent, the Department of the Interior. The proposed board, among other things, would have control over Alaska water powers. Secretary Wallace holds that the board would remove wholesome checks against exploitation of vast natural resources besides depriving Alaska of the benefits of federal agencies.

"The Federal Power Commission is just now getting established," said Secretary Wallace, "and it is reasonable to expect that under its administration the development of water power throughout the nation will be promoted on sound economic lines. This is a matter of great importance to Alaska. The manufacture of paper is likely to be one of the dominant industries in that territory. A large supply of timber and an abundant supply of water power are essential to this industry. The erection of pulp mills and the development of hydro-electric power in southeastern Alaska will go hand in hand. Therefore it would be most unfortunate if that territory should be deprived of the services of the Federal Power Commission and the power resources of Alaska be placed in the hands of such a board as it is now proposed to create and deprived of the help of all the governmental organizations from which otherwise it might secure technical assistance and advice."

Need for Scientific Research on Large Scale Urged

A SYMPOSIUM of evidence on the benefits to industry resulting from scientific research has been made public by the Engineering Foundation, which is working with the division of engineering of the National Research Council. Among those who have urged the need of research on a large scale are Dr. Charles L. Reese, chemical director of the E. I. du Pont de Nemours Company; A. J. Wadhams, general superintendent of the National Nickel Company; Prof. Joseph W. Richards, Lehigh University; Prof. M. I. Pupin, Columbia University; J. Vipond Davies, president United Engineering Society; H. Hobart Porter of Sanderson & Porter, and George H. Pegram of the Interborough Rapid Transit Company.

Shamokin, Pa., to Have Large Plant.—A three-million-dollar hydro-electric plant for Shamokin, Pa., is planned by the Pennsylvania Light & Power Company, which, it is announced, will utilize an existing dam between Shamokin and Seinburg.

Oshkosh Defeats Municipal Ownership.—The electors of Oshkosh, Wis., recently voted upon a proposition providing for the purchase by the municipality of the gas and electric light plants of the Oshkosh Gas Light Company. The project was defeated by a vote of three to one.

Wireless Progress in Finland.—Finland, which has hitherto had only a small 3-kw. wireless station with a range which would not carry messages much beyond Copenhagen, has just installed two new stations at Helsingfors, a 25-kw. Daniel-Poulsen system and a 35-kw. Marconi system, which will enable communication to take place with the whole of central Europe.

Popular Interest in Electrical Refrigeration. — One hundred visitors every hour examined the exhibits at the recent electric refrigeration show of the New York Edison Company, which lasted for a week. Tradesmen and merchants who wanted to know about equipment for retail shops were most numerous, with those interested in home equipment not far behind. Engineers and engineering students formed a third group, and men desirous of establishing selling agencies a fourth. Heating and ventilating exhibitions will be given by this company in June.

Mexico's Hydro-Electric Progress.—Concerning the hydro-electric plant that is being constructed near Madera, in the Mexican State of Chihuahua, at a cost of $300,000 by the Dolores Mining Company, a dispatch to the *Manufacturers' Record* says: "The plant will generate 2,000 hp., and the electrical energy employed in ore reduction will, in addition to being used to operate the machinery and mill of the company, be transmitted to outlying mining camps and industrial centers for a distance of 40 miles. It is expected that the operation of this plant will solve the fuel question, which for some time has been troublesome in this part of Mexico."

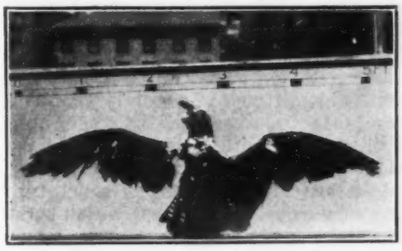
Electric "Fish Stops" Demonstrate Their Efficiency.—An electric device for preventing fish from entering irrigation canals has been perfected by a Washington State county game warden. He sets a double row of steel piles in a frame and drives this in the intake of the irrigation canal. The piles are electrically wired and the current set through them charges a curtain of water about 12 ft. long and the width of the canal. Actual trial, it is said, proves that fish will not voluntarily enter this electrified water, but turn back, and a considerable number of the "fish stops" are to be installed this year in the hope of preventing the loss of millions of fish fry in irrigating ditches.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Wireless Between Italy and United States.—According to an announcement made recently at Rome by the Marquis di Solari, work will soon be begun on a powerful wireless station near Pisa for regular communication with the United States. Operation of the plant in 1922 is hoped for, the Marquis said in an address before the Italo-American Association.

Fish Hawk Comes Out Second Best in Bout with Electricity.—From G. M. Leach, general superintendent of the Atlantic City (N. J.) Electric Company, comes the accompanying picture of the remains of a powerful but imperfectly educated fish hawk which recently attempted to take possession of



a pole near Longport, N. J., to which the company's 22,000-volt transmission line is attached. The bird's head and left wing were burned off, but it scored to the extent of interrupting service for several minutes while the cause of the short circuit was being sought.

Milwaukee Claims Largest Indirect Lighting Fixture.—An indirect lighting unit 15 ft. in diameter and containing 118 lamps has recently been hung over the center of the auditorium of the Alhambra Theater, Milwaukee. This fixture, which weighs nearly 5,500 lb., is said to be the largest of its kind in the world. One hundred of the lamps are rated at 200 watts and the remainder at 60 watts.

Seventy-five per Cent of Canadian Houses Where Energy Is Available Are Wired.—Returns from a questionnaire sent out by the *Electrical News* of Toronto indicate that in Canadian communities where electrical energy is available 74.9 per cent of residential buildings are wired. The percentage of houses using electrical appliances ranges down from 45.7 with electric flatirons and 18.2 with electric toasters to 0.7 with electric dishwashers and 0.6 with electric refrigerators. Five per cent use electric vacuum cleaners, 3.1 per cent electric ranges, 5.9 per cent electric washing machines, 5.4 per cent electric fans and 1.2 per cent sewing-machine motors.

Peru May Nationalize Her Water Power.—A bill sponsored by the Finance Minister was recently introduced into the Congress of Peru which provides for the nationalization of water power in that republic. Under the terms of this bill all water-power concessions will be granted under the provisions of the mining laws by the authorities therein appointed.

Pan-American Conference Backs Radio Development.—The second Pan-American financial conference appointed a permanent committee on communications which has adopted a resolution urging Congress to authorize the navy to accept wireless press messages to and from South America. The committee also favors the enactment of legislation for the erection of a high-powered radio station on the west coast of Africa.

Preparing for Automatic Telephoning in New York.—The new building of the New York Telephone Company on East Thirtieth and East Thirty-first Streets will, it is announced, be completed about June 1. This exchange, which will be equipped with machine switching apparatus for automatic service, is eight stories and basement in height and has a frontage of 170 ft. on Thirtieth and 101 ft. on Thirty-first Street. The electrical installation calls for eight 80-hp. and four 43-hp. generator sets and 640 ⅛-hp. duplex motors for the operation of the machine-switching apparatus. It is hoped to inaugurate automatic service at some central offices this year, though it will be several years before the whole city can be served in this way. In the greater city there are now more than 900,000 telephone stations served from 101 central offices.

Hydro-Electric Project to Serve Wellington, N. Z.—The Mangahao hydro-electric project, designed to supply power to the city of Wellington, New Zealand, is thus described by the *Electrical Times* of London: "The power-house site is two or three miles away from the railway station, at the foot of the first range. A tunnel about a mile long is to penetrate these hills to the valley of the Tokomaru and Arapiti streams. In this valley will be the first reservoir, really a lake formed by damming the stream at a narrow gorge just below a wide flat, the site of a growing settlement destined a few years hence to disappear beneath the waters. Beyond the next ridge, which is also to be tunneled, is the Mangahao gorge containing the stream that is to furnish the greater part of the water for the power station. A 90-ft. dam in the Mangahao gorge is to create a second reservoir through the tunnel. A third reservoir is to be formed about a mile and a half further up the stream. The salient feature of the scheme is the diversion of water from the two valleys, set high in the hills, to the power house on the Shannon flat, where the steel pipe lines will deliver it with a head sufficient to drive a group of Pelton wheels coupled to dynamos capable of producing 24,000 hp."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Continued Service to Consumer in Default Is Discrimination. — The Gary Heat, Light & Water Company has been ordered by the Public Service Commission of Indiana to discontinue service to a customer who has refused to pay for gas consumed by him because, owing to tampering with the meter connections by unknown persons, the amount of consumption was not registered on his meter. The commission holds that to continue service to a customer in default is to discriminate against the company's other patrons.

Commission Insists on Full Knowledge of Salaries Paid by Utilities.—Information having been given to the California Railroad Commisson that the salary of the president of the Great Western Power Company includes a percentage of the company's net income, the commission ordered the company to make a report showing the full effect of this arrangement, declaring that, while it sympathizes with officers who object to the invasion of their privacy, it "will at all times insist that information regarding salaries paid public utility administrative officers be given the commission for such use, within reason, as may be deemed necessary."

Apportionment of Bills After Rate Change.—In allowing a gas company to apportion gas bills according to the number of days between meter readings at the date upon which a new rate schedule went into effect the Public Service Commission of Pennsylvania expressed the opinion that "an apportionment on the basis of time is the only practicable method and is one that will work substantial justice, even though it may not be exactly correct for an individual case." In a similar case the Washington state commission ordered that the increased rate should be collected from all customers whose meters were read on and after a certain date.

Departments of Dual Utility Company Must Stand on Own Merits.—Holding in an application by the Elmira Water, Light & Railroad Company for increased street-railway fares that rates for the electric lighting service and the railway service of a dual utility company may properly be considered contemporaneously, the New York Public Service Commission for the Second District insisted that none the less each must stand on its respective merits, declaring: "The consumers of electric light and power should not be called upon to pay higher rates by reason of the fact that the railroad operations were not yielding an adequate revenue, nor on the other hand should the trolley passengers pay a fare more than sufficient to maintain that industry because the electric lighting consumers were not paying an adequate price for service furnished to them."

Decision for Company in Case Where Necessity of New Power House Was Questioned.—In granting increased city rates to the Binghamton Light, Heat & Power Company, the New York Public Service Commission for the Second District refused to deduct from the rate base either the value of an old generating plant still used as a distributing station, storehouse, repair shops and "cold standby" or the value of a new power house built primarily to enable the company to supply adjoining municipalities. The commission disregarded the theory that the old power house would have been adequate to the city's demands, it being established that the rates in the city would be much higher were it not for the new plant. The company was directed to make a study of the subject of service and demand charges.

Increase in Contract Rate Between Companies Authorized.—A dispute over the right of the Narragansett Electric Lighting Company to increase its rate for power furnished to the Attleboro (Mass.) Steam & Electric Company despite the existence of a twenty-year contract has been resolved by the Public Utilities Commission of Rhode Island in favor of the Narragansett company, which has also been authorized to put the new rates into effect without the statutory notice of thirty days. This decision was reached as the result of the failure of the two companies to adjust the dispute between themselves, the commission having previously deferred decision to afford them an opportunity to do so. The commission's order asserts that continued enforcement of the contract rate would result in a loss to the supplying company and thus discriminate against other consumers.

Profitable and Unprofitable Years Must Be Considered Together.—Refusing to accept the theory that surplus accumulated from operating revenues has no bearing on the question of rates, the Connecticut Public Utilities Commission said, in denying the request of a gas company for increased rates: "If a utility company during a long term of prosperous years has been able from excess earnings to set aside a substantial depreciation reserve fund and to accumulate a large surplus account, a considerable portion of which is represented not alone by book entry but by actual cash investment, it should not when an emergency arises disregard such accounts and expect its patrons to meet the emergency and bear all the immediate burdens of maintaining the company at its previous standard." A large cash surplus, the commission held, should be drawn upon in lean years before asking increases in rates.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

N. E. L. A., Iowa Section.—The annual convention of this section will be held at the Inn Hotel, Lake Okoboji, Iowa, on June 22, 23 and 24.

Western Society of Engineers.—The following officers have been elected for this society, their terms beginning on June 1: President, Charles H. MacDowell, president Armour Sterilizer Works; first vice-president, Julius L. Hecht, assistant to vice-president Public Service Company of Northern Illinois; second vice-president, F. F. Fowle; third vice-president, Benjamin B. Shapiro; treasurer, Homer E. Niesz; trustee, Edwin W. Allen.

West Virginia and Kentucky Engineers Organize.—A society to be known as the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers was recently formed at Huntington, W. Va., for educational purposes. Officers elected are: President, J. H. Edwards, Huntington; vice-president, W. R. Harler, Eccles; secretary-treasurer, Herbert Smith, Huntington. The executive committee will be composed of J. J. Fluck, Huntington; J. S. Shepherd, Omar; C. H. Tyler, Sharples; J. B. Pennman, Deegans; R. R. Webster, Weeksbury, Ky., and Lewis Hill, Winding Gulf.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Akron, May 25; San Francisco, May 27.

American Society of Mechanical Engineers—Chicago, May 23-26. (For program see issue of May 7, page 1069.)

Electrical Supply Jobbers' Association—Hot Springs, Va., May 25-27. (For program see issue of May 14, page 1121.)

American Society of Safety Engineers—New York, May 27.

N. E. L. A. Annual Convention—Chicago, May 31-June 3. (For program see issue of May 7, page 1065.)

N. E. L. A., Pacific Coast Division—Del Monte, Cal., June 7-9. (For program see issue of Jan. 29, page 278.)

N. E. L. A., North Central Division—Duluth, Minn., June 14-16.

National Fire Protection Association—San Francisco, June 14-16.

Tri-State Water and Light Association—Asheville, N. C., June 15-16.

Canadian Electrical Association—Quebec, June 15-17.

California State Association of Electrical Contractors and Dealers—Santa Cruz, June 16-18.

A. I. E. E. Annual Convention—Salt Lake City, June 20-25. (For program see issue of April 30, page 1009.)

National District Heating Association—Cedar Point, Ohio, June 22-24. (For program see issue of May 7, page 1069.)

N. E. L. A., Iowa Section—Lake Okoboji, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ontario, June 23-25.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 27-30.

Definition of "Police Power."—The following definition of "police power" was given by the Court of Civil Appeals of Texas, in Rumbo vs. Winterrowd: "Police power is that authority which resides in every sovereignty to pass all laws for the internal regulation and government of the state necessary for public welfare." (228 S. W. 258.)*

Manager and Part Owner of Small Utility May Receive Compensation for Injury Received While Doing Manual Work.—The Court of Appeals of New York has found, in Hubbs vs. Addison Electric Light & Power Company, that the manager of a small electric utility who also owned a large part of its stock can recover damages under the workmen's compensation act for injuries received while performing manual duties in the plant, he receiving a weekly salary as manager and his work including the duties during the performance of which he was injured. (130 N. E. 302.)

"High Degree of Care" and "Ordinary Care."—In sustaining a verdict for the defendant in Jackson vs. Goldin, a suit for damages because of electric shock, the Court of Appeals of Georgia found no error in the instructions given by the lower court to the jury as to the degree of care imperative on the maintainer of electrical equipment. The duty to exercise a high degree of care, the court held, does not change the rule requiring only "ordinary care," because "ordinary care" is that reasonable care and caution which an ordinary cautious and prudent person would exercise under the same or similar circumstances. (106 S. E. 12.)

Admissions of One Co-defendant Company in Damage Suit No Defense for Other.—Damages for the death of a boy from a gas explosion in a public street were sought from both the gas company and an electric light company which was alleged to have broken a gas main in laying an electric conduit over it (Nugent vs. Boston Consolidated Gas Company; same vs. Edison Electric Illuminating Company). The Supreme Judicial Court of Massachusetts has determined (1) that the admissions of the gas company or proof of negligence or unauthorized acts on its part were not a defense for the electric company; (2) that the electric company, having placed its conduit in a public way, was bound thereafter to use due care in its maintenance under whatever conditions might come into existence; (3) that the two public service companies could have been found to have been joint tort feasors; (4) that the testimony of a qualified witness that the cause of the break of the gas pipe was the weight of the electric company's conduit on top of a cross, the loose ground under the cross and the settlement of the conduit and vibration of street cars was properly admitted, being competent in the issue of negligence. Verdicts against both companies were sustained. (130 N. E. 488.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Damages Cannot Be Recovered for Neglect to Guard High-Tension Wire Where This Was Not Proximate Cause of Fatality.—In a suit (Golson vs. W. F. Covington Manufacturing Company) brought to recover damages for the death of a child who came into contact with a bare wire that some unknown person had thrown over a high-tension wire maintained by a contractor on the premises of the manufacturing company, it was held by the Supreme Court of Alabama that, although the company was under obligation to exercise reasonable care, including inspection, to guard against danger to persons not trespassers who might go upon the premises, the burden of proof to show that the dangerous condition had existed long enough for the proprietor to have notice of it was on the plaintiff. The Supreme Court sustained the verdict in the lower court for the defendant, holding that failure to guard the high-tension wire was not the proximate cause of the death. Whether the child was a trespasser, an invitee or a licensee was, however, for the jury to decide. (87 So. 439.)

Responsibility of Power Company Because of Contact Between Its Wires and Those of Light Company.—Sustaining a verdict for the plaintiff in Thombs vs. Montgomery Light & Water Power Company, where damages were awarded for the death of a customer of the Montgomery Light & Traction Company, the wires of the latter company entering deceased's home having become heavily charged through contact with the wires of the former company, the Supreme Court of Alabama, however, reduced the damages awarded from $25,000 to $15,000. The Supreme Court held that the trial court did not err in refusing the following instructions to the jury: (1) That a verdict should be found for the defendant if the danger arose from the negligence of another company; (2) that suit should have been brought against the light company; (3) that the negligence of the light company was the proximate cause of the death (this instruction was properly refused for ignoring the issue of concurrent negligence); (4) that defendant owed no duty to plaintiff's intestate to inspect its wires to correct a dangerous condition existing without its negligence. The alleged fact that the light company's wires were erected subsequently to those of the power company was not held to absolve the power company from the duty of inspection. The trial judge, however the Supreme Court held, properly ordered the jury to disregard a plea from the plaintiff's lawyer for punitive damages as a means of influencing the defendant to put its wires underground. (87 So. 205.)

Franchise Covering Night Service Only Must Be Construed According to Its Terms.—Action taken by the State Corporation Commission of Virginia has been sustained by the Supreme Court of Appeals of that state in City of Clifton Forge vs. Virginia-Western Power Company. In this case the company's franchise required it only to furnish incandescent light in the dark hours, but the company had also for ten years been furnishing day service. The latter fact, the court held, did not estop the company from applying to the commission for permission to withdraw daytime service or for a determination of adequate service and proper rates therefor. The commission's powers in the matter were sustained, it being held that under the law the city had ample opportunity to be heard as to the justness of the rates charged. (106 S. E. 400.)

Contracts Between Municipality and Utility Under Michigan Law.—In a contest between the City of Saginaw and the Consumers' Power Company over rates as affected by ordinance and contract, the Supreme Court of Michigan made these among other findings: (1) Where by ordinance a power company had the right to the use of city streets and, subject to maximum-rate and arbitration provisions, the right to fix commercial rates, no amendment of the ordinance was needed to permit it by contract to fix such rates for an agreed period; (2) where a power company included with a bid for street lighting a schedule of rates for other purposes which the city accepted in accepting the bid for street lighting the two proposals became a part of the same transaction; (3) where a contract was to continue for ten years unless the city gave written notice that it should terminate at the end of the first five years and no such notice was given, both parties were bound for the ten-year period; (4) a ten-year lighting contract which allowed an additional seven months for installation of equipment did not violate a law limiting the endurance of such contracts to ten years; (5) the company could not set up an alleged unlawful inducement made by it in entering into a contract as a reason for declaring the contract void, as this would be allowing it to set up its own wrongdoing to defeat the executory portion of its contract; (6) a contract entered into by the city in disregard of a law requiring competitive bidding could not bind the city, and the city, not being itself bound, could not compel the company to perform the contract, but where there is no mandatory provision for competitive bidding the city is bound; (7) a public service corporation cannot refuse to furnish service on the ground that the contract under which it operates lacks mutuality in not stating definitely the amount to be paid. (182 N. W. 146.)

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Charles Edwin Mitchell, president of the National City Company of New York, who has been also elected president of the National City Bank, succeeding James A. Stillman, received

C. E. MITCHELL

his early training in electrical work. After being graduated from Amherst College in 1899 he entered the employ of the Western Electric Company in Chicago. Three years later he was made credit man for the company and shortly thereafter assistant to the president. From this position he was promoted to be assistant manager and received direct supervision of the purchasing and sales departments in the West as well as of the engineering and manufacturing work. In 1906 Mr. Mitchell resigned to become assistant to the president of the Trust Company of America in New York City, which led up to the organization of the investment banking firm of C. E. Mitchell & Company. At the height of this firm's prosperity Mr. Mitchell accepted a call to the National City Company in 1916 as its vice-president and active manager. In October, 1916, he was elected president, which position he still holds in addition to the presidency of the National City Bank. The National City Company is now one of the largest investment security houses in the country and has been closely identified with the financing of many prominent electric public utilities, railroads, industrial, municipal and foreign projects.

G. Gordan Gale has been elected president of the Canadian Electric Railway. Mr. Gale is vice-president and general manager of the Hull (Quebec) Electric Company.

Tate G. Glenn has been appointed service manager of the Consumers' Light & Power Company, Ardmore, Okla.

Renier Beeuwkes, chief electrical engineer of the Chicago, Milwaukee & St. Paul Railway, who has recently received several months' leave of absence, sailed from New York City on May 11 for Panama and South American ports.

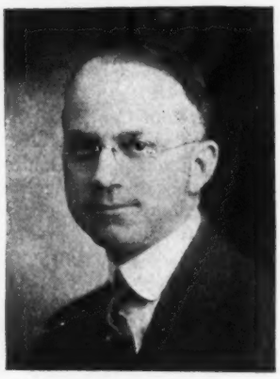
C. H. Mueller has been placed in charge of the electrical testing division of the Duquesne Light Company, Pittsburgh, as superintendent. Mr. Mueller was formerly connected with the circuit-testing division.

Benjamin F. Pearson, who has recently been appointed manager of operations of the Southern California Edison Company, will have charge of all of the operations of that company's system. This will include the generating stations, transmission lines, substations and distribution lines. Mr. Pearson formerly was superintendent of the southern division of the Southern California Edison Company, a position he had held since the consolidation of the Pacific Light & Power Company and the Southern California Edison Company in 1917. Before that he was general superintendent of the Southern California company's system. Mr. Pearson has been employed by that company continuously for more than twenty-five years, rising through the positions of

B. F. PEARSON

power-house foreman, superintendent of transmission and superintendent of generation to the post of general superintendent. A more complete biographical notice appeared in the ELECTRICAL WORLD for May 8, 1920.

H. G. Steele, formerly vice-president and manager of the Pittsburgh Transformer Company, is now the president and treasurer of the U. S. Electrical Manufacturing Company of Los Angeles. Mr. Steele was born in Harrisonburg, Va., in 1881, and attended the public schools in Pittsburgh, Pa. Immediately after graduation from school he became associated with the Pittsburgh Transformer Company at the time of its formation in 1899. Beginning with a capital of $10,000 and a total volume of business of $20,000, that company expanded so greatly in twenty years that last year its business totaled more than $2,000,000. Mr.



H. G. STEELE

Steele then sold his interests and became associated with C. E. Johnson of the U. S. Electrical Manufacturing Company of Los Angeles, the latter company being reorganized and Mr. Steele becoming its president and treasurer. This reorganization has been effected with a view toward greatly increased activity. During the war Mr. Steele served as chairman of the transformer committee of the War Industries Board.

C. W. Whiting, consulting engineer, Boston, has been appointed manager of the Wakefield (Mass.) Municipal Light Department for a period of one year. Mr. Whiting has had an extended consulting experience in municipal plant work in Massachusetts, New Hampshire and New Brunswick.

J. N. van der Ley, mechanical and electrical engineer and superintendent of the government service for water and electricity in the Dutch East Indies, is beginning a tour of this country to become familiar with the recent hydro-electric installations. In addition he will make a study of railway electrification and will visit the factories of the principal electrical manufacturers. Mr. van der Ley recently arrived on the Pacific Coast. After visiting all sections of this coast he will travel east through the northern portion of the country and visit Chicago, Niagara Falls and New York before sailing for England.

William G. Yates, formerly general manager of the Adams-Bagnall Electric Company and for more than fifteen years connected with electrical jobbing and manufacturing concerns in the Middle West, has organized the William G. Yates Company of Cleveland to manufacture a light household ironing machine which will be known as the "cottage ironer." While with the Adams-Bagnall Electric Company, prior to its absorption last year by the National Screw & Tack Company, Mr. Yates built up a fractional-horsepower motor business to a production of more than 5,000 a month in less than nine months' time, although previously he

W. G. YATES

had been engaged in sales and administrative work and had had no manufacturing experience. Associated with him in the William G. Yates Company will be several men well known in the electrical industry.

O. H. Koch, one of the members of the American Engineering Council's executive board, has just completed visits to member societies in New Orleans, Birmingham and Nashville. He reports that these societies are very much interested in the activities of the Federated American Engineering Societies.

L. W. Wallace, the executive secretary of the Federated American Engineering Societies, has returned to his office in Washington after a visit to Milwaukee, Detroit and Chicago. At Milwaukee he addressed the Society of Industrial Engineers on industrial leadership. At Detroit he spoke at the annual banquet of the local engineering societies. In Chicago he attended a meeting of the American Engineering Council's committee dealing with the licensing of engineers.

E. E. Brazier, who has been in charge of the automobile accessories sales department of the Capital Electric Company, electrical jobber in Salt Lake City, has been promoted to the position of general sales manager. Mr. Brazier has had a wide experience in the sales branch of the electrical industry.

C. A. Sticht has been appointed New York City district manager for the Valley Electric Company, St. Louis. The office of the company is in the Bush Terminal Sales Building, 130 West Forty-second Street.

Henry R. Towne, head of the Yale & Towne Manufacturing Company, Stamford, Conn., has been elected to honorary membership in the American Society of Mechanical Engineers. Mr. Towne has been a member of that society since 1882 and served as its vice-president during 1884-1886 and as its president in 1889. In 1868 he formed a partnership with Linus Yale, which resulted in the organization of the Yale & Towne Manufacturing Company. Mr. Towne directed this company as president until 1915, when he became chairman of the board.

Frederick Hayes Wilkins, European general manager of the International Western Electric Company, with headquarters in London, has been elected a vice-president of the company. Mr. Wilkins was born at Sennett, N. Y., in 1861, and educated at the University of Rochester. He entered the employ of the Western Electric Company forty years ago, eventually becoming manager of its New York branch. He went to Europe in 1910 to look over foreign trade conditions and a year later was made European general manager of the company.

J. T. Marron, president of the Electrical Construction & Machinery Company, former president of the Marron Manufacturing Company and for twenty-two years a manufacturer at Rock Island, has given up his business associations in that city and moved to Preston, Iowa, where he has purchased the Rural Power Company's plant. A high-tension line will be run from Clinton to Preston, Goose Lake, Miles, Sherlock, Bryan and Spragueville, serving these towns as well as rural districts with light and power. F. M. Burt, secretary of the Electrical Construction & Machinery Company, will be associated with Mr. Marron in the new enterprise. J. J. Murphy, also of Rock Island, will go to Preston as chief engineer of the lighting plant.

R. W. Van Pelt has been appointed sales representative for the St. Louis territory for the Maring Wire Company, Muskegon, Mich., manufacturer of enameled, cotton and silk-covered magnet wire.

Senator William B. McKinley, president of the Illinois Traction System, was elected president of the Mississippi Valley Association at its recent meeting, held in New Orleans.

H. N. Spencer, president of the Howell Motors Company, Howell, Mich., is spending a year or more in New York making a study of corporation finance in preparation for a program of expansion to be undertaken in about two

H. N. SPENCER

years. Mr. Spencer, who is also president of the Spencer-Smith Machine Company, was one of the founders of the Howell Motors Company five years ago. The company has had a very rapid growth, its orders last year being in excess of $1,000,000.

Victor T. Goggin, late New England sales manager of Fred T. Ley & Company, Inc., of Springfield, Boston and New York, has severed his connection with that concern to associate himself as contracting engineer with Dwight P. Robinson & Company, Inc., of New York City.

Obituary

Frank Clifton Owen, treasurer of the Miller-Owen Electric Company, Inc., Pittsburgh, dealer in electrical supplies, died on April 22.

Robert G. Tobey, for thirty years secretary of the Massachusetts Gas and Electric Light Commission, predecessor of the Massachusetts Department of Public Utilities in gas and electric company regulation, died at Boston on May 5. Mr. Tobey was born at Falmouth, Mass., in 1840, and prior to his connection with the commission was treasurer of the Mount Washington Glass Company of New Bedford, Mass. He was closely identified with the administration of the accounting system prescribed for the utilities of Massachusetts and for the municipal plants of the state.

Charles Hosmer Morse, for many years chairman of the board of directors of Fairbanks, Morse & Company, manufacturers of engines, motors and pumps, died at Orlando, Fla., May 5, after an illness of two months. He was eighty-eight years old. Mr. Morse entered the employ of the company, then known as E. & T. Fairbanks & Company, in 1850, and became president in 1872. He was a director of the First National Bank, the First Trust and Savings Bank and the National Safe Deposit Company, all of Chicago.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Refractory Prices Lower Under Reduced Output

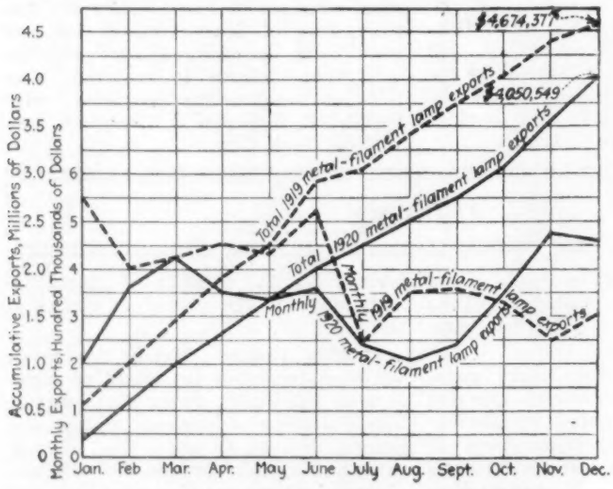
WITH the iron and steel mills operating at somewhere around a 40 per cent rate and with glass makers operating at about 25 per cent normal capacity, the demand for refractories likewise is at a low ebb. Production, consequently, is in the neighborhood of 25 per cent, some of the larger producers working at a slightly higher rate, while among the smaller producers some shutdowns have been reported. Stocks, however, are in sufficient quantity to last over three or four weeks of normal demand, but at the same time steel mills still have some materials on hand.

This supply at the refractory plants should prove of assistance on a returning steel market. An improved sentiment has been noticed in this industry, particularly in the automobile field. Although this outlet consumes only about 5 per cent of the steel output, an increase in automobile consumption at this time is an encouraging condition.

Recent price reductions in the refractory market brought Pennsylvania fireclay brick down $2 per 1,000, while in the middle of April magnesite brick was reduced $10 per net ton in standard sizes, silica brick came down $5 per ton, $5 per net ton was applied to chrome brick and from $2 to $5 to fireclay brick.

Metal-Filament Lamp Exports Lower in 1920

DURING the year 1920 exports of metal-filament lamps from the United States showed a lower value than they did in 1919 in the ratio of $4,050,549 to $4,674,377. It is significant that Brazil, Argentina, Colombia, Peru, Chile and Uruguay—all South American countries—purchased far fewer of these lamps from the United States in 1920 than in 1919. Venezuela, however, increased her amount. It is known that since the armistice Germany has been paying considerable attention to the South American market. Likewise Australia, British South Africa and British India bought fewer in this market in 1920 than in 1919, while New Zealand increased her purchases of American lamps. A tie-in with British lamp producers would not be unexpected here.



MONTHLY LAMP EXPORTS SHOW NO REGULARITY

In the table below, the figures in which were compiled by the ELECTRICAL WORLD from Bureau of Foreign and Domestic Commerce data, there are sixteen countries which in 1920 imported over $50,000 worth of American metal-filament lamps. Further more, the succeeding five countries, although they were under this amount in 1920, in the year 1919 imported very much higher amounts. The six-teen highest countries in 1920 imported $3,559,697 worth of lamps, while in the year previous they took from the States $4,275,583 worth. Consequently the remaining sixty-five countries absorbed almost 25 per cent more lamps in 1920 than in 1919 in the ratio of $490,852 to $398,794.

Canada continues as the heaviest importer here, and Cuba and Mexico also are holding up well.

1920 AND 1919 METAL-FILAMENT LAMP EXPORTS

Country	Value of 1920 Exports	Value of 1919 Exports
Canada	$974,411	$901,927
Cuba	605,747	262,210
Brazil	465,451	686,672
Mexico	315,489	352,392
Belgium	166,431	31,788
Argentina	153,266	449,169
Australia	117,052	231,555
Colombia	89,432	125,799
Italy	80,546	197,742
Panama	71,932	38,456
New Zealand	70,954	59,094
British South Africa	68,846	126,937
Peru	65,149	99,561
Venezuela	57,795	32,707
Chile	57,283	147,784
China	50,604	33,630
Uruguay	36,611	93,903
Philippine Islands	35,731	161,349
British India	35,067	72,819
Dutch East Indies	24,046	98,922
Denmark	17,854	71,167
65 miscellaneous countries	490,852	398,794
Total metal-filament lamp exports	$4,050,549	$4,674,377

Good Future Seen in Steel Transmission Tower Market

A SURVEY of the foreign and domestic market for steel transmission towers reveals fairly uniform conditions among producers. Present activity at home and abroad is very light, there being little or no demand for this class of material as yet this year. Furthermore, there does not seem to be much prospect of greater buying developing later in the year, for customers are still holding off for lower prices and difficulty in financing new transmission projects continues to retard the market.

In view of the position of this market as a barometer in the electrical industry, however, it is gratifying to note that producers are generally quite optimistic over the future. At the present time several companies report that they are receiving a large number of inquiries both in the United States and from foreign countries. Actual orders, as stated heretofore, are not being placed, but at the same time the pulse of the market is being closely felt and interest on the part of central-station companies and electric railways is considerable. From all accounts it seems that there is a large potential demand which is being held in abeyance.

The average base price on galvanized material used in fabricating steel towers is now said to be about 7 cents. There does not seem to be much chance of further price de-

creases being made, it is stated, unless steel declines further. The extent of price reductions made by different producers varies somewhat, but in a representative instance prices have receded approximately 30 per cent from the peak reached about one year ago. This figure is based upon the cost of one particular job which was figured last spring and finally held over until this year.

Deliveries can be made promptly, for though the finished product is not stocked, steel mills are keen for business and fill orders in quick time. Some producers are also carrying good stocks of material ready for fabrication.

Active Market for Electric Signs and Accessories

THE electric sign business is one branch of the electrical industry that seems to be quite active at this time. Spring months have brought in a good amount of business, and this is expected to continue until well into the summer months. The New York territory is reported to be the most active, and communities in that neighborhood have been buying well. Boston is good, and New England as a whole presents a fair market. Chicago and Detroit centers also show fair activity, although the Southern States are not so good.

The above may be applied to what may be termed the strictly electric sign business, both flasher and continuous. Within the past few years small automatically operated advertising signs in cabinet form, table signs, counter and showcase signs and window signs—some continuous, some motor-driven, some flasher-controlled—have come into the market in large numbers and varieties, and new developments in this type of sign are appearing all the time. Their market is strong and it is getting more active continually.

With all the activity the factories are not quite up to capacity as a whole. Standard equipment can be shipped in two days to a week, but it takes up to three weeks to get out special designs and sizes, except in the largest sizes for roof placement. Flashers, lamps, color caps, sockets and receptacles and other accessories can be had quickly. As with the signs, the accessories too are having a good call, flasher signs becoming more popular.

Prices show little tendency to drop. Lamps are still unchanged in price, as are flashers, porcelain, sockets and labor. Wire is lower, and with it sheets and paint. Time clocks for sign control are finding an active market, and their deliveries are running up to three months' time.

Flexible Armored Conductor Prices Are Shaded

PRICES of flexible armored conductor are being readily shaded, a survey of the situation reveals. There is keen competition for business among producers with considerable shopping around on the part of buyers, so that as large a concession as $5 per 1,000 ft. below the prevailing market price is being granted by some of the smaller manufacturers. The general Pittsburgh base price quoted at present is $55, with 5 per cent off for cash.

A fair current amount of business is being received, sufficient to maintain operation of plants, though probably twice as much as is being produced at present could be turned out if necessary. Steel strip is not being stocked by cable manufacturers in large quantities, despite the reduction in price made about the middle of last month coincident with the drop in steel prices. A large producer is now quoting $8.75 per 100 lb. on steel strip in carload lots, this price representing a drop of 75 cents about a month ago. Deliveries of this material are made in two weeks or less, as demand for it is only fair.

Good stocks of flexible armored conductor are held throughout the country so that immediate shipments can be obtained, but the general policy now is to reduce inventories. The market is expected to continue rather quiet through the greater part of this year, for although there is a good volume of building work on the horizon, it will very probably be postponed awaiting lower labor and other costs.

British Manufacturers Active in Standardization

DURING the war the great importance of standardization in the economic production of machinery and apparatus on a large scale was deeply impressed upon the members of the British Electrical and Allied Manufacturers' Association. At the annual general meeting of this association, held on April 17, it was brought out that in order to deal more effectively with this work several sections have set up permanent technical committees, usually in conjunction with the standardization committee, and these are carrying out work to form foundations on which the British Engineering Standards Association can build a final text. They comprise the accessories, dynamo and motor, switchgear, instrument, meter and transformer committees, and they have prepared drafts and specifications for dynamos and motors, carbon brushes, enameled wire, plugs and sockets, lamp holders, motor starting and controlling switches, etc.

The switchgear section has prepared a revised edition of its purchasing specifications, slate panels and slabs, and in collaboration with the insulation section has standardized a complete line of molded insulating bushings for use in switchgear and allied work. The industrial instrument section has also, in collaboration with the switchgear and meter sections, provided standard drilling centers for the ends of instruments and meter shunts. These standardizations will be embodied in future editions of the association rules. The stationary and portable storage-battery sections have standardized the relative capacities of batteries of all rates of discharge, together with final voltages. Standard curves have been plotted, and these have been accepted by government departments and large buyers. A curve for portable storage batteries has been adopted as a standard British practice by the Association of Motor Manufacturers and Traders.

The Metal Market Situation

PRESENT demand for copper is quiet, but there has been some firming of the market since a week ago. This has been caused chiefly by increased export buying which resulted from Germany's agreeing to the reparations settlement. This buying, which came largely from Germany and Japan, was brisk last week, but since then has fallen off. The clarification of the European outlook, however, is expected to improve the international credit situation, and this in turn should react on copper buying.

Domestic demand is only fair, but producers are holding to their prices firmly. Meanwhile the statistical position continues to improve, for production is being cut to the bone. The general asking price for prompt and May shipment is 13 cents delivered, with 13⅛ cents for June, though it is understood that one interest at least is shading these prices. Little business is being done in the outside market.

Sheet zinc changed to 10 cents, the market remaining quiet with no selling pressure. The tin market is dull as the chief consumers, the tinplate makers, are buying little or nothing. Lead holds its recent advances, but its position is slightly easier, owing in part to declines at London.

NEW YORK METAL MARKET PRICE

	May 10, 1921	May 17, 1921
Copper	£ s d	£ s d
London, standard spot	72 0 0	74 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00—13.25	13.00—13.25
Electrolytic	12.75	13.00
Casting	12.12½	12.25
Wire base	14.50—15.00	14.50—15.00
Lead, trust price	5.00	5.00
Antimony	5.25	5.25
Nickel, Ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	11.00	10.00
Zinc, spot	5.40	5.35
Tin	31.87½	33.00
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.00—10.50	10.25—10.62½
Brass, heavy	5.50— 5.75	5.25— 5.50
Brass, light	3.75— 4.00	4.00— 4.12½
Lead, heavy	4.10— 4.37½	4.25— 4.50
Zinc, old scrap	2.87½— 3.00	2.50— 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS conditions in the electrical supply jobbing trade show up a little better in reports from Chicago, St. Louis and Atlanta. There is considerable unevenness in New England, New York shows no change for the good, and the West Coast is about in a similar condition. Improved collections are noted in Chicago and St. Louis, small contractors in the South seem to be paying cash, New England shows up spotty, and the West has no better report.

Farm-line materials are moving better in the Middle West with better crop movement. Residence wiring supplies and appliances have a good call in St. Louis territory. Meters are fair. The South is improving in wiring supplies sales, and municipalities and small central stations are buying better. In New England ranges, washers and storage batteries stand out well in sales. Conduit fittings and outlet boxes are reported 15 per cent lower there. California building permits for April excel those for last April. Washers are moving well. In the Northwest washers also are moving well, building is under way, and second-hand motors, wire and conduit are reported in a strong market.

A new catalog, No. 23, shows list or discount changes effecting reductions in Benjamin lines, except in panelboards and marine items.

NEW YORK

Trade in the electrical industry remains unchanged in this section. Jobbers report that the market is very quiet on all supply items, but some, however, continue to see a slight upward trend. Stocks are down low and are being kept there, for buying in every department is for maintenance only. The credit situation remains unchanged, being far from satisfactory on the whole.

With the light demand that is felt competition is naturally very keen and prices are readily shaded. This is reflected in soft quotations on armored cable and on rubber-covered wire. Manufacturers have recently announced price decreases on several electrical lines. Renewable fuses have dropped about 17 per cent, fuse wire and links 20 per cent. floor boxes 17 per cent, steel switch boxes 10 per cent and connectors from 12 to 22 per cent.

Conduit.—Not much is moving and stocks are down fairly low. Prices show no change over those quoted last week.

Flexible Armored Conductor.—The market has further softened with considerable competition among jobbers. Demand is very light and stocks are down. As low as $55 for 1,000 ft. of No. 14 double-strip is quoted by reputable houses this week.

Non-Metallic Flexible Conduit.—Little or no supply is moving. Manufacturers' prices are unchanged, with jobbers quoting from $22 to $24.25 on 1,000 ft. of $\frac{7}{32}$-in. and from $24 to $26.25 on $\frac{1}{4}$-in.

Tape.—Prices cover quite a range, from a low of about 40 cents on friction and 36 cents on rubber to a high price of 50 cents per pound on each, lots of 100 lb. Buying is slight and stocks are low.

Rubber-Covered Wire.—Conditions have not changed any. The price of No. 14 single-braid in 10,000-ft. lots varies from $6.75 to $7.50 per 1,000 ft.

Fuses. — Price reductions on renewable fuses are announced by several manufacturers, effective May 16. The cut is virtually uniform and amounts to an increase of ten points in the discount, or about 17 per cent.

Fuse Wire and Links. — A leading manufacturer has reduced prices about 20 per cent by increasing the discount allowed distributers 15 points.

Boxes.—At least one manufacturer has reduced the price of floor boxes 17 per cent, effective May 16. The change was made by increasing the discount ten points. From another source comes word of a decrease amounting to 1 cent each on steel switch boxes, effective May 6. This is equivalent to about 10 per cent.

Connectors. — Armored conductor connectors are lower. Effective May 12, one manufacturer reduced certain types $10 per 1,000 and on others which were quoted at list is now giving 20 per cent off. Another producer, effective May 16, made a flat cut of $5 per 1,000, bringing prices to the same level as those effective by the ten-dollar decrease above mentioned.

CHICAGO

A slightly improved market is noted on all sides this week, not alone in the electrical field. The slight change for the better in the number of men out of employment is felt in increased retail sales in all lines, and the gradual liquidation of crops by the farmers in the Northwest is causing an improvement in conditions there This was reflected by the placing of orders for equipment of several farmer lines and by a better tone to the market for line material.

Aside from farm-line equipment, there is little activity in power apparatus. Prices have stood firm, but the scanty volume of inquiries seems to indicate that price has little to do with the volume of sales. The only requirements for motors, either large or small, are for replacement and fill-in purposes, a few going to machinery dealers. Rural collections are better.

Locally the conditions are unchanged. The construction lockout persists, with the unions sticking firm and the contractors talking of reducing their offer for skilled labor still further. The probability is that a compromise will be effected at somewhere in the neighborhood of $1.05 per hour. If peace comes in time, it means the immediate start on upward of $30,000,000 worth of work of all classes.

Bare Copper Wire.—As was the case two weeks ago when the market on electrolytic sagged sharply, bare copper wire has failed to follow this week's fluctuations in price but has stood firm at $16.50 per 100 lb. in ordinary quantities. On large sales prices 1 cent lower are mentioned. Sales are quite numerous but are confined almost wholly to small orders.

Insulated Copper Wire.—Prices on insulated wire remain unchanged, the base on weatherproof holding firm at 16½ cents per pound. This makes the quotation on No. 6 triple-braid 17 cents per pound in 1,000 lb. lots. Rubber-covered is finding small sale owing to restricted building conditions in this city and is quoted at $7 per 1,000 ft. in 10,000-ft. lots.

Black Conduit.—The slight reduction reported three weeks ago has induced no boost in business, as with no building in progress there is no demand for pipe. Quotations are unchanged at $62 per 1,000 ft. for ½-in. in 5,000-lb. lots.

Flexible Armored Conductor.—Reduced building requirements and firm prices combine to hold sales at a low level. While present prices are said to be justified by costs, much talk is heard of the price being too high. In 5,000-ft. lots $62 per 1,000 ft. is asked for the No. 14, two-wire.

Line Hardware.—No recent change in prices has occurred, and orders are not in proportion to inquiries. Typical prices are: For hot-galvanized cross-arm braces, 1¼ in. x ¼ in. x 24 in., N. E. L. A. specification, less than 500, $168.72 per 1,000, 500 to 1,500, $149.97 per 1,000, over 1,500, $132.33 per 1,000; for hot-galvanized machine bolts, ⅝ in. x 12 in., in similar quantities, $14.35, $12.75 and $11.25 per 1,000.

Lineman's Tools.—All talk of shortage of lineman's tools has disappeared. Prices are unchanged. Price to dealers on a Klein No. 102-1, 7-in. splicing clamp is $28 per dozen; on a No. 201, 7-in. side cutting pliers, $30 per dozen. Inquiries are plentiful and orders show some improvement in the last few days.

Ground Tools.—No new price lists have been issued since Jan. 15, and prices established at that time seem high in the light of sharply reduced raw-material costs. Heavy maple peavies, 2½ in. x 4½ ft., are $43.40 per doz.; fir pike poles 2½ in. x 14 ft., are $36.10 per dozen, and maple-handled spoons, 8 ft. long, are $38.30. Reductions are freely predicted, and as a result sales are light.

BOSTON

Reports indicate uneven trade conditions this week, some days displaying good orders and others a quiet demand. A better feeling, however, dominates most branches of the industry. Bright spots on the business map are labeled "electric ranges," "washing machines" and "storage batteries." Stocks are excellent in most lines, although if the public should begin buying on a large scale long deliveries would not be unlikely in some commodities. The building and engineering contracts announced last week in New England totaled $5,230,100, which is a considerable improvement over the late winter records. The open-shop idea continues to gain headway around Boston notwithstanding long-drawn-out strikes. Collections are spotty, some of the best settlements being on a sixty-day basis. Few good accounts, however, are running as long as ninety days. Improvement in business is noted in the Vermont stone-quarrying field, and in some seaside towns north of Boston the use of electricity is rapidly accelerating from week to week. Prices showed weakness in non-metallic flexible conduit this week, and conduit fittings are off about 15 per cent.

Electric Ranges.—Demand continues good, with increasing inquiries. A leading New England factory is running five days a week and is making stock deliveries. Some retailers reporting other business quiet speak of the range outlook as unusually good. Prices are steady.

Flexible Armored Conductor.—Little of this material is changing hands. Prices are soft, No. 14 single-strip selling at Boston for $55 per 1,000 ft. in 5,000-ft. lots.

Non-Metallic Flexible Conduit.—Prices are a little weak and the demand is very moderate. The ½-in. size sells for $21 per 1,000 ft. in 5,000-ft. lots, the ⅝-in. size bringing $23.50.

Wire.—Rubber-covered No. 14 sold Monday for $7.25 per 1,000 ft. in a representative 5,000-ft. lot, but prices are not very firm in the face of actual orders. Weatherproof base is around 16 cents and bare base about 15½ cents. Wire prices are unsettled. No great demand exists.

Radiant Heaters.—Despite a poor spring for electric radiators, jobbers are ordering conservatively for the fall trade and some factory orders are being put through. Warm weather during the period of low fires hindered sales. Some summer business is in sight, however. Prices show little change.

Conduit Fittings.—A decline ranging around 15 per cent is announced in outlet boxes with two or three exceptions. Representative discounts from list are as follows: Stamped steel boxes and covers, black, 25 per cent; galvanized, 15 per cent, on less than $10 list. From $50 to $500 list the black boxes are quoted 40 per cent and galvanized 33⅓ per cent. Gang switch boxes, less than 100, are quoted 15 per cent on black and 5 per cent on galvanized. Boxes for flexible armored conductor sell for 25 cents each in lots of less than 50 and for 20 cents each in lots of 100 or over.

Motors.—Although motor sales are at a low volume, odd purchases here and there keep adding to central-station loads. Shoe and accessory plants are buying motors in a small way and many companies are noting a steady though moderate net gain in connected power loads.

Fans.—Deferred warm weather has kept the fans on the shelves so far. Little preliminary buying is reported.

Knife Switches.—A rearrangement of prices is announced on the basis of discounts from double-manufacturers' list. A leading type shows a discount of 42½ per cent off double list on less than $50 list to 57½ per cent off in $400 list and over. Revived building operations are absorbing moderate quantities of wiring material.

ATLANTA

Electrical jobbing firms report that the last ten days have witnessed considerable improvement in their business, especially in lines of building and wiring material, the movement of household appliances, however, continuing rather dull. Most of the orders that are being received are coming from the small contractors who in a great many instances are paying cash for their purchases. The larger contractors, however, have placed no heavy orders as yet, though an unusual amount of interest is being displayed through requests for quotations on large prospective purchases. Activities in the rural districts and small towns, as a whole, continue slow, though it is reported that around the large mill centers, particularly in North Carolina, the demand for electric wiring material is better than it has been for some months past. The peach crop in middle Georgia has begun to move, and prospects indicate the finest season for this fruit that has been experienced for many years. Unless some unforeseen event interferes, the marketing of this crop should put between $7,000,000 and $10,000,000 in the fruit section of this state within the next thirty days. This will, of course, relieve the financial tension and stimulate business activities throughout the middle part of the state.

No further change is to be reported from the industrial field, most of the textile mills being forced to undertake a fair percentage of curtailment, while the fertilizer plants are not up to their normal operating schedule. Jobbers report an increasing number of orders from municipalities and small central stations, the demand being largely for maintenance material and, in a few isolated instances, for new construction.

Ranges.—No activity worthy of note can be reported; stocks continue heavy and few inquiries are being received. There has been no further price reduction since that of approximately sixty days ago.

Outlet and Switch Boxes.—These are moving very nicely and stocks are being maintained in good condition. Shipments have improved materially, orders being filled by factory within ten days of their receipt.

Vacuum Cleaners.—Despite the fact that at this time of the year cleaners should be moving briskly, few sales are being reported. Stocks accumulated in anticipation of a demand have not been disposed of and large quantities are on hand throughout the territory.

Flexible Armored Conductor.—This continues to move very satisfactorily, one of the largest jobbers reporting the receipt of orders this week sufficient to wipe out current stock. Other jobbers have very fair stocks on hand and report shipments good. Price, two-wire, No. 14, single-strip, $72 per 1,000 ft.

Lock-Nuts and Bushings.—Jobbers have been unable to reduce their holdings materially on this item, in which little or no demand is discovered. No material movement is anticipated until pipe is in more demand.

Dry Batteries.—Rural telephone companies are taking the normal supply of batteries, and sales to commercial houses continue to hold up well. No price changes are noted and stocks are in good condition.

Fuses.—Cartridge fuses are very slow, but plug fuses in the 5, 10 and 15-amp. sizes are reported quite active, apparently indicating activity in the small residence and commercial line. Stocks of both types are in excellent shape.

Wire.—Another price reduction of 5 per cent in rubber-covered is reported this week. The movement of rubber-covered continues about the same as for several weeks past, the price reduction apparently not stimulating sales. Weatherproof in popular sizes continues to move fairly well. Stocks of both varieties are on hand in quantity. Price, No. 14, lots of 5,000 ft., $7.55 per 1,000 ft.

ST. LOUIS

Except for a cut in the price of copper wire, there was no development of especial importance during the past week. This reduction, coming at a time when every one was feeling that the bottom in the market for wire had been reached.

had a tendency to confuse the buyers of wire, and a decrease in sales for the week is reported. It is now generally felt, however, that the absolute bottom in price has been reached, and a tendency to stock is expected on the part of contractors. Appliances are showing a healthy increase in demand, particularly in those items which are featured during the summer months. Demand for materials entering into the construction of residences shows steady improvement, but that for industrials is still quite slow.

Many of the manufacturers have a fairly satisfactory demand, while others are working on a hand-to-mouth basis, particularly in the metal industries. Rolling mills are operating intermittently as orders accumulate and iron foundries are doing practically nothing. The demand seems to be waiting for lower cost of iron and steel, lower freight rates and lower wages. The railroad situation is not at all satisfactory, first because the high rates tend to eliminate the distant markets, and second because their financial position does not permit extensive purchasing, the lack of which has a noticeable effect upon local industries.

Collections are reported to be improving, the average basis being from forty-five to sixty days. Money is easier than it has been for some time, but conservatism still marks the loans now made. On the whole, it can be said that the business situation during the week shows improvement.

Wire.—A reduction of 1 cent per pound in the base rate on bare, weather-proof and rubber-covered marks the past week. The new base is 15 cents. No. 14 rubber-covered, in 25,000-ft. lots, can now be purchased from $6.50 to $7 per 1,000 ft., and in special cases probably as low as $6.35. The demand for bare and weatherproof continues dull, and that for rubber-covered shows some decline because of uncertainty of the market. With the present prices, which would appear to be as low as they can possibly get for some time, it is expected that a materially improved demand will soon appear. The reduction is attributed to reduction on the part of manufacturers as the local stocks are not considered at all heavy except in one or two instances.

Flatirons.—A reduction in the list price of several makes was made last week. Stocks of all irons are in satisfactory shape and the demand is reasonably good, gradual improvement being noted as the summer season approaches.

Meters.—One jobber reports a normal demand for meters and others report a reasonably good business. This is occasioned by the increased residential construction and the transmission extensions being made by the utilities.

Flexible Armored Conductor.—Lower prices prevail, No. 14 double strip being about $5 per 1,000 ft. lower and selling around $60 per 1,000 ft. in 5,000-ft. lots. Stocks are somewhat heavy, and the demand, while still low, shows slight improvement.

Flashlamps.—The demand shows improvement and the market is quite steady. The call for battery renewals has at no time since the present depression began shown any weakness and all jobbers are reporting a good renewal business.

Commercial Lighting Fixtures. — A fair business is reported and stocks are said to be on a reasonable basis. The low demand is due to the lack of industrial and construction activity.

Fans.—As the summer season approaches the jobbers and retailers are doing practically no buying, for it is appreciated that the manufacturers have large stocks which can be drawn from in the event of heavy demand. None care to have extensive stocks on hand at the end of this season, it being anticipated that prices next year must be lower. The prices of the fans this year may be a detriment to the retail trade.

SAN FRANCISCO

The seamen's strike is still unsettled and few cargoes are being shipped. The San Francisco strike of seventeen affiliated building trades unions is still continuing and all work on all large buildings is at a standstill. Sooner or later this will automatically stop electrical work, as is evidenced in the present cautious buying of wiring staples. This 7½ per cent wage decrease has extended to Oakland and other bay cities, where it has begun to affect the building.

The value of the building permits issued during April, 1921, in the four principal California cities is as follows: San Francisco, $1,913,592; Los Angeles, $6,915,216; Oakland, $1,321,246; San Diego, $1,657,055. The figures for April, 1920, were as follows: San Francisco, $2,000,672; Los Angeles, $3,076,763; Oakland, $765,797; San Diego, $294,511. These figures reflect very fairly the present condition of the electrical wiring business in each city as compared with that for the same period last year.

Household Material.—The sale of washing machines is very quiet, that of vacuum cleaners much better, of dishwashers excellent. Sewing machines are rather quiet. Simplex ironing machines recently dropped from 15 per cent to 20 per cent in the standard sizes. A significant feature is the number of special demonstrations on all household devices now being held by the larger merchants.

Telephones.—Telephone sales are rather quiet, whether for intercommunicating, hotel or apartment house installations or for rural lines. Deliveries are better and local stocks fair in variety. Comparatively few so-called farmers' lines are being built or are even under serious consideration.

Fans.—Although the actual fan season will not be here for at least another month, advance sales point to a very big season, exceeding last year's, and this despite the fact that the spring has been unusually backward.

Farm Plants.—Sales of farm plants are running considerably behind last year. There are probably three factors responsible, the failures of growers in many rural districts to dispose profitably of last year's crops, a general expectation by the buying public of decrease in all lines, and slackening of sales efforts for these reasons.

SEATTLE—PORTLAND

Sales volumes and business in general among the electrical fraternity during the month of May to date have been about the same as during April. Jobbers attribute present conditions to lack of interest on the part of the buying public and to the number of failures of small dealers throughout the district, mainly in the surburban towns. The same conditions are expected to place other dealers out of the running within sixty days unless business picks up materially. The outlook for summer business is not promising, although a comparatively ambitious building program of public and semi-public buildings just starting is expected to augment sales volumes, particularly of schedule materials, wiring and conduit. Washing machines are strong sellers at present, although the sales of this appliance are not nearly so large as could reasonably be expected. A temporary decrease in prices of several makes of ranges amounting to approximately 25 per cent obtaining for about sixty days enabled manufacturers and jobbers to move stocks, although they were forced to accept losses. Now ranges are selling for their original price, which is expected to hold until fall. It is believed that rubber-covered wire is at the bottom but that others of these bread-and-butter articles will show further decreases, the drops coming slowly.

Portland manufacturers report that conditions have not changed except that there is a more optimistic feeling expressed than there was a few weeks ago. Jobbers report business spotty. Collections are poor and cannot be forced. Contracting in Portland still continues uncertain, and the retail stores have nothing encouraging to report.

Motors.—Jobbers, especially in Seattle, report that there are enough second-hand motors on the market to curtail new sales for a year. These came from industrial war-working plants, including shipyards which have been or are being dismantled. Second-hand motors in good condition can be purchased for half price, and industrial plants, including lumber mills contemplating electrical installations, are taking advantage of this opportunity. Considerable second-hand wire and conduit in the hands of junk dealers purchased from war-time industrials is hampering sales of new materials.

Fixtures.—Sales volumes are showing a nice increase, with continued increase in residence construction. Stocks are in good shape and prices are holding comparatively firm.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Triangle Conduit Opens Factory in Chicago

On May 5 the Triangle Conduit Company, Inc., Brooklyn, N. Y., opened its Western factory at 1965 West Pershing Road, Chicago, where there is 15,000 sq.ft. available for manufacturing space. Armored conductors, armored lamp cord and flexible steel conduit will be manufactured in this new plant, but stocks of the company's non-metallic flexible conduit, "tri-cord," etc., will be carried there in addition to stocks of the steel materials made there.

New Manufacturers' Agent Opens in Detroit

E. G. Bartling, who was formerly associated with W. D. Woolley in New York City, has established an office in the Detroit Savings Bank Building in Detroit. He will act as manufacturers' agent and up to date has taken on the representation of the Federal Porcelain Company, Carey, Ohio; Fernando C. Mesa, Irvington, N. J., in porcelain lines, and the William Wurdack Electric Manufacturing Company, St. Louis, for switch boxes.

Lalley Light Figuring on Peace-Time Costs

In commenting upon the general conditions which today hold up the economic course of business, and which are gradually clearing, William H. Lalley, president of the Lalley Light Corporation, Detroit, states that he has ignored his inventory and commitment prices, figured on present material markets, and where these have not reached the levels he feels that they should reach has speculated on such suppliers soon seeing the light of reason. And with it all, only a fair margin of profit—based on peace-time ideas and not war-time ideas—is figured.

Trust Company Finances Payments on "Universal" Washers

In order that "Universal" dealers may have the necessary capital to finance business taken on a time-payment plan, Landers, Frary & Clark, New Britain, Conn., have made an arrangement with the Commercial Investment Trust Company, 347 Madison Avenue, New York, whereby all dealers who can submit to them satisfactory credit references will be enabled to finance, without drawing on their own capital, their sales of "Universal" electric clothes washers with deferred payments running over a period of twelve months. The manufacturer states that the plan is simple in its working and is limited in amount only by the individual dealer's credit and resources.

Westinghouse's Annual Report Shows Favorable Balance

Billings of the Westinghouse Electric & Manufacturing Company for the fiscal year ended March 31, 1921, from the company's annual report just issued, amounted to $150,980,106.39. The estimate for the calendar year 1920 was $150,000,000, as shown in the April 9 issue of the ELECTRICAL WORLD. The net manufacturing profit on the year's business was $12,206,021, even after taking out $5,315,196 for depreciation and adjustment of inventories. An appropriation for a special contingent reserve of $5,000,000 has also been made from surplus to provide for further possible shrinkages and adjustments in the inventories. Total surplus on March 31, 1921, amounted to $56,053,299 after adding a net income for the year of $12,617,535.

Property and plant account shows an increase over the previous year of $9,361,403 and embraces construction completed during the year. An important extension was made to the works at Lester, Pa., where the manufacture of steam turbines, condensers and marine propulsion apparatus is now concentrated, making available additional manufacturing space at East Pittsburgh for electrical apparatus. An additional lamp factory was erected during the year at Indianapolis, Ind., and extensions were made to the plants at Milwaukee, Bloomfield, Bridgeport, Mansfield and East Springfield, Mass. Developments and investments were made in the wireless field and other high-frequency current fields.

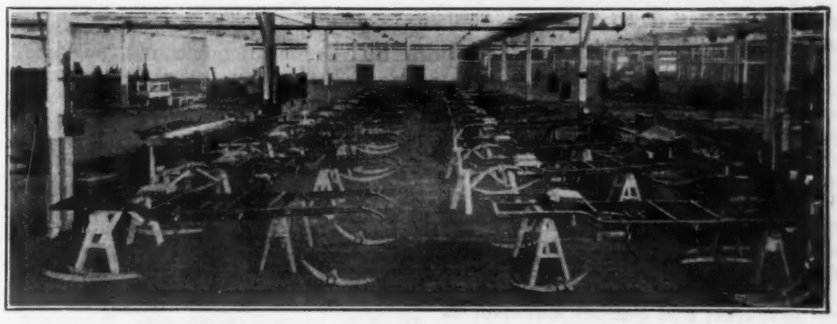
Accounts receivable amounted to $34,551,599, while inventories embrace $80,724,389. Total capital stock is $74,812,650.

Time-Clock Maker Still Long on Shipments

The time-clock business of the electrical industry is one branch that apparently is maintaining a high level of activity. Albert & J. N. Anderson Manufacturing Company, 289 A Street, Boston, is running at high capacity, and shipments on time clocks for street lighting circuits and sign circuits are still behind. From three to five months, depending on the type of clock, is the quoted shipping time now, and this is about one month better than the time quoted a month ago. Factory capacity was doubled during the past winter.

Rauch & Lang's High Production in New England

The new factory of Rauch & Lang, Inc., makers of the Raulang electric passenger automobile at Willimansett, Mass., is rapidly approaching capacity production for the first unit of the plant. In January, 1921, a modern one-story brick factory, 320 ft. x 300 ft., began to produce cars, and since its opening it has been running on full time, with some overtime in addition. About $350,000 was invested in the plant exclusive of real estate.



DEMAND IS KEEPING PRODUCTION UP TO CAPACITY IN NEW PLANT

Two hundred and fifty employees are now at work in the plant, and the orders on the books and coming in will keep the factory going at full speed until fall. It will probably be necessary to add to the force before long. The factory work has now been transferred from Cleveland to Willimansett, and the company expects shortly to manufacture there its own motor of the Hertner design. Bodies are not yet produced at the Willimansett plant. The proximity of this site to various New England concerns supplying important parts, the labor supply in the Connecticut Valley and the potential New England market were among the important factors leading to the establishment of the new plant in Massachusetts.

Paul A. Frank is president, and the three vice-presidents, Harry R. Doernig, Nathaniel Platt and R. W. Stanley, are respectively sales manager, export manager and general manager.

Kellogg Switchboard Financial Statement for 1920

In its annual report for the year ended Dec. 31, 1920, the Kellogg Switchboard & Supply Company, Chicago, shows total assets of $7,527,311 and a surplus and reserve of $2,236,458. Inventories amounted to $3,431,937 and accounts receivable $2,089,805. Capital stock is just under $5,000,000.

French Carbon Maker Investigating United States Market

E. Gindre, president and general manager of Le Carbone of Paris, France, is in the United States for an extended period for the purpose of investigating the prospects in the carbon and carbon-brush business incidental to the possibility of expanding his service in the United States.

Change in Name and Organization of Vim Electric

The Vim Electric Company, Inc., is the new name taken by the Vim Electric & Motor Company, 66 Cortlandt Street, New York City, following its recent reorganization. The company has expanded its scope of service beyond that of motor agents and will now handle and install motors and generators and their accessories, both new and used equipment. It is also prepared to maintain such installations and to act in a consulting and engineering capacity. A rental service for motors is another feature. Special attention will be given to sales of General Electric and Sprague equipment. The entire building of five stories and basement, containing 5,000 sq.ft., has been rented and is being renovated. Stocks will be maintained on the premises.

George Smith is president and general manager, and Samuel Kassover is vice-president.

Water-Heater Developments of Automatic Electric

The Automatic Electric Heater Company, Warren, Pa., in developing its heater line, has put into production two new 3-gal. models of its "Sepco" automatic water heaters, rated at 600 watts and 1,000 watts respectively, and has gone on with the larger sizes. Field tests have been completed in the 8, 20 and 40-gal. sizes, and these will be placed in production as rapidly as possible, probably by fall.

Electric Vehicle Development Brings Out New Light Car

What is believed to be an entirely new development in the electric vehicle field has recently been announced in the manufacture by the Automatic Transportation Company, Buffalo, N. Y., of a small-size "Exide" battery, electric passenger vehicle. It is put out for the use of executives in industrial plants and also for passenger service. The wheel base is only 61½ in. and the tread 35 in., while a 24-volt motor is used to attain a speed of 15 miles an hour over a 50-mile radius on a single battery charge.

Expansion of Output Planned by Pacific Refractory Maker

To replace a plant destroyed by fire at another site a short time ago, the Pacific Clay Products Company, American Bank Building, Los Angeles, Cal., expects to start construction on a new factory at Los Nietos for the manufacture of firebrick and refractory shapes. This plant will have an initial output of 25,000 9-in. brick per day and will be laid out for a maximum capacity of 40,000. This is somewhat greater than the capacity of the old plant, but the 25,000 quantity, it is expected, will be absorbed by the territory supplied by the old plant, which means that the consumption in that territory has increased. With the establishment of quieter conditions and equitable freight rates the company expects to ship firebrick and refractories to Mexico and other Pacific Coast countries.

E. M. Durant is president and Archibald Douglass is secretary.

Partnership of Manufacturers' Agents in New York

Cooper & Gershvin, a partnership, has been formed by W. H. Cooper, formerly in the electrical publishing business, and A. J. Gershvin, an electrical engineer formerly in business in Europe, with offices at 98 Park Place, New York City. Representation has been secured for the Detroit Electrical Branding Iron Company, Baco Electrical Company's soldering irons, Ree-Nu-It Electrical Manufacturing Company's renewable fuses, Laduby Company's lamp locks, Milwaukee Manufacturing Company's immersion heaters, C. & P. Electric Works' panels and cut-outs, Renner & Maris' portable lamps and B. & W. Specialty Manufacturing Company's heating appliance connectors. The territory served will be New York State and the Metropolitan district, which takes in New York City, New Jersey and Connecticut.

Exclusive Appliance Distributers for Sunbeam's Output

The Sunbeam Domestic Appliance Co., which recently took over the Surf Manufacturing Company of Milwaukee, is still manufacturing "Surf" washing machines in that city and will do so until removal to its new plant in Evansville, Ind., takes place some time in June. A production basis of fifty machines per day is expected shortly. The company is directing most of its efforts and distribution through the exclusive appliance distributer. Besides its connections in most of the larger cities it maintains a branch office at 431 Sutter Street, San Francisco, under H. R. Basford, and a stock of machines at that city and at Los Angeles. W. A. Carson is president, O. F. Fischedick vice-president, and E. D. Weymss secretary.

The Combustion Engineering Corporation has moved its general offices from 11 Broadway to the Combustion Engineering Building, 43-47 Broad Street, New York City.

The Bryant Electric Company, Bridgeport, Conn., has moved its Chicago office to 844 West Adams Street, where it has larger quarters.

The Sessions Engineering Company announces the removal of its offices to 832 Marquette Building, 140 South Dearborn Street, Chicago.

The Globe Electric Company, Inc., Seattle, Wash., announces the removal of its place of business from 906 Western Avenue to 313 Occidental Avenue. The company deals in wholesale electrical supplies, apparatus, etc.

The Louisville Electric Manufacturing Company, Louisville, Ky., has filed amended articles of incorporation placing its preferred capital stock at $15,000 instead of $25,000 and increasing its common stock from $50,000 to $60,000.

The Anker Engineering Company, Widener Building, Philadelphia, has made arrangements with the Wodack Electric Tool Corporation, 23-27 South Jefferson Street, Chicago, to act as its representative in the Pennsylvania district and surrounding territory.

The Crawford Manufacturing Company has removed its New York office from 277 Broadway to 13-21 Park Row.

The Philadelphia Fire Underwriters' Association, Philadelphia, announces that its electrical department is established at Room 400, Bullitt Building, 131-141 South Fourth Street.

The Star Porcelain Company, Muirhead Avenue, Trenton, N. J., manufacturer of electrical porcelain products, contemplates the erection of an addition, 30 ft. x 100 ft., two stories.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, announces that it is now represented in Pittsburgh by D. C. Paul, formerly with the Gaul, Deer & Shearer Company, Philadelphia. The Pittsburgh office is at 303 Penn Avenue, where there is also a completely equipped service station with a factory-trained service man in charge. This branch, of which Mr. Paul is manager, includes western New York, western Pennsylvania and the northern part of West Virginia.

The Arrow Electric Company, Hartford, Conn., announces that its new York sales office has been removed from 253 Broadway to the Borden Building, 350 Madison Avenue.

Alfred Box & Company, 813 North Front Street, Philadelphia, is contemplating the erection of a new machine shop, 110 ft. x 300 ft., one-story, at Tioga and Trenton Streets, to cost about $100,000. The company manufactures cranes, hoisting machinery, etc.

The De Laval Steam Turbine Company, North Clinton Street, Trenton, N. J., has awarded contract for the erection of a three-story machine shop, 160 ft. x 220 ft., to cost with equipment about $150,000.

Foreign Trade Notes

GENERATING PLANT FOR BUENOS AIRES.—Tenders will be received by the Board of Sanitary Works of the Nation, Buenos Aires, Argentina, until June 3, according to *Electrical Industries*, for the construction of a new generating station. The equipment consists of three four-cycle Diesel engines of 375 hp., adapted to run on crude petroleum from Comodoro Rivadavia, and three 250-kw., three-phase, 2,200-volt alternators. Tenders for this work were previously called for in 1919 and 1920. A copy (in Spanish) of general conditions of tender and specifications of plant, etc., may be seen at the Department of Overseas Trade, 35 Old Queen Street, S.W. 1, London, England.

STATIC CONDENSERS FOR NEW ZEALAND.—Tenders will be received by Secretary of Public Works Department, Tenders Board, Government Buildings, Wellington, New Zealand, until June 28 for furnishing and delivering at Lyttelton two 50-kva., condensers, two 100-kva., and two 200-kva. condensers in connection with the Lake Coleridge electric power supply project. Copies of specifications may be seen on application to the Department of Overseas Trade, 35 Old Queen Street, Westminster, S. W. 1, London, England.

ELECTRIC PLANT FOR SANITARY WORKS, BUENOS AIRES.—The Department of Sanitary Works, Buenos Aires, Argentina, according to *Electrical Industries*, is asking for tenders until June 13 for furnishing and erecting electric power batteries and lighting plant at Mar del Plata.

TENDERS SOON TO BE CALLED FOR ON ELECTRIC FURNACE IN AUSTRALIA. — According to *Electrical Industries*, owing to falling prices the Railways Department of Victoria, Australia, has rejected all tenders received up to Jan. 19, 1921, for furnishing an electric furnace for the Newport workshops. The department, it is understood, will ask for tenders closing in September. The present cost is estimated at £50,000.

TRANSFORMERS FOR NEW ZEALAND.—Tenders will be received by the Secretary of Public Works, Tenders Board, Government Building, Wellington, New Zealand, until June 28, according to *Electrical Industries*, for ten single-phase, oil-filled transformers for the conversion of three-phase current at 50 cycles, the voltage ratio being 50,000/11,000, in connection with the Waikato electric power scheme. Copies of specifications on application to the Department of Overseas Trade, 35 Old Queen Street (Room 59), Westminster, S. W. 1, London, England.

ELECTRIC GENERATING MACHINERY FOR SOUTH AFRICA.—The Borough Council of Kingwilliamstown, South Africa, according to the *Electrical Times*, will receive tenders until Aug. 1 for steam-driven electric generating machinery, boilers, switchgear and cable, or alternate for gas-driven plant. Specifications and further information from the borough engineer, Kingwilliamstown, applications to be accompanied by a deposit of £2 2s. Tenders should be addressed to the town clerk.

ELECTRIFICATION OF PHILIPPINE RAILROAD.—According to the *Bulletin of Government Commercial Agency in New York*, the Manila Railroad Company plans to develop the water power of the Agno River in central Luzon to supply electricity to operate the railroad. It is estimated that from 12,000 hp. to 15,000 hp. can be developed.

ELECTRIFICATION OF RAILWAYS IN SOUTH AFRICA.—Tenders will be received by the High Commissioner for the Union of South Africa, Trafalgar Square, London, England, or office of the general manager, Johannesburg, South Africa, until June 22 for equipment, switchgear and accessories, etc., in connection with the electrification of the Cape Town-Simonstown and the Durban-Pietermaritzburg railway lines. Specifications, etc., at the above offices. Further information on application to Merz & McLellan, consulting engineers, 32 Victoria Street, S. W. 1, London, England.

BROWN, BOVERI EXPANDS IN POLAND.—Brown, Boveri & Company, Baden, Switzerland, together with the Bank of the United Polish Countries of Warsaw, have just formed a company under the name of Polish Electric Works-Brown Boveri Limited, at Warsaw. The object of this new enterprise is the manufacture in Poland of line and other electric material as well as of all kinds of electric machinery, apparatus and appliances. For this purpose a large factory will be built at Trzebin in Poland and the workshops of the Electric Company Limited, formerly Sokolnicki & Wisniewski, at Lemberg, in Galicia, now belonging to Poland, will be acquired and operated by the new company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm of machinery dealers in Ceylon (No. 34,836) desires to be placed in communication with manufacturers of electric drying units with a view to developing their use in drying tea.

A business man in the Canary Islands (No. 34,856) proposes to establish an electric light and power plant for a town of about 5,000 inhabitants and requests catalogs and quotations.

A manufacturers' representative in Peru desires to secure an agency on a commission basis for the sale of electrical appliances, etc.

New Apparatus and Publications

ELECTRIC VEHICLE.— The Automatic Transportation Company, Buffalo, has developed a small electric vehicle for executive use in industrial plants and for pleasure. Electric Storage Battery's sales bulletin for April describes the car.

PORTABLE LAMP.—The Griest Manufacturing Company, New Haven, Conn., maker of the Wallace lamp, has just developed a new portable lamp for table and bedstead use.

VALVES.—The Lunkenheimer Company, Cincinnati, is distributing a small booklet describing its "Ferrenewo" valves.

CONTROL VALVE. — Bulletin R-1401, with supplementary sheet No. 2, issued by the Yarnall-Waring Company, Chestnut Hill, Philadelphia, describes its "Yarway" balanced control valve in both angle and globe patterns recently developed by the company.

INDUSTRIAL TRACTORS AND TRUCKS.—The Baker R & L Company, Cleveland, is distributing bulletin 10, describing the "Baker" series C Industrial tractors and trucks with duplex compensating suspension.

VALVES.—The A. W. Cash Company, Decatur, Ill., is distributing a small folder describing its single-seat class D valve.

REGULATORS. — The Craig Damper Regulator Company, 701 Book Building, Detroit, has issued a small folder describing the Craig damper regulator.

CONTROL APPARATUS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, is distributing leaflet 3,982, describing its type F magnetic-switch double-section control panels, together with type 22-F magnetic-switch control panels. Folder 4,455, entitled "Fans for Efficiency," describes the Ventura fans.

ELECTRIC HOISTS. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 1819, covering its different types of electric hoists.

METALS. — "Armco in Pictures and Fact" is the title of a new 247-page publication on the manufacture of "Armco" iron, recently issued by the American Rolling Mill Company, Middletown, Ohio.

SUPPLIES. — Benjamin Electric Manufacturing Company, Chicago, has just issued its 252-page Catalog No. 23, showing price reductions.

METER SERVICE.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has developed a new type of meter service switch under the Sachs patent. Circular No. 50 describes it.

ELECTRIC IRONER.—The William G. Yates Company, Cleveland, has recently placed on the market its new 46-in. "Cottage" ironer for small family needs.

TELLTALE BOARDS. — Bulletin No. 49,011, issued by the General Electric Company, describes its running-light telltale boards for vessels using electricity.

DISCHARGE TEST SET.—The Hickok Electrical Instrument Company, Cleveland, is distributing bulletin No. 21, describing the new Hickok high-rate test set for storage-battery service stations.

LIGHTING FIXTURES.—The Luminous Unit Company, division of the St. Louis Brass Manufacturing Company, St. Louis, has issued "Brascolite" bulletin No. 1, showing various hospitals that are equipped with "Brascolites," "Aglites," etc.

AMMETERS AND VOLTMETERS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 400, covering its type "TID" (formerly "Junior Imp" type) direct-current ammeters and voltmeters. Bulletin No. 419 describes the "FID" voltmeters and ammeters for direct current (formerly 4-in. "Imp" type).

New Incorporations

THE HALL PRODUCTS COMPANY, Ridgewood, N. J., has been incorporated with a capital stock of $10,000 by George I. Hall and Henry and Runis Amos. The company proposes to manufacture electrical appliances.

THE RUBICON COMPANY, Philadelphia, has been incorporated with a capital stock of $20,000 to manufacture electrical devices and equipment. Josef Doerr, Elkins Park, Pa., is treasurer.

THE WHALEY - CROSBY ELECTRIC CORPORATION has been incorporated under the laws of Delaware, with a capital stock of $1,000,000, to manufacture and deal in electrical supplies. The incorporators are T. L. Croteau, M. A. Bruce and S. E. Dill, Wilmington.

THE GREENFIELD ELECTRIC SUPPLY COMPANY, Brooklyn, N. Y., has been incorporated by A. L. Rush, S. Dampf and A. S. Greenfield, 995 Eastern Parkway. The company is capitalized at $25,000 and proposes to manufacture and deal in electrical supplies.

THE UNION ELECTRIC COMPANY, Union Mills, Ind., has been incorporated with a capital stock of $15,000 to operate an electric light plant. The directors are C. S. Hillabold, M. J. Hillabold and A. L. Ullrich.

THE SOUTHERN CHAIN BATTERY SYSTEM has been incorporated with a capital stock of $300,000 for the purpose of manufacturing a battery for automobile trade. I. B. Stevens, J. T. Snow and E. E. Harroun of Nashville, Tenn., are incorporators.

THE NEW SWEDEN (ME.) LIGHT & POWER COMPANY has been organized to operate a local power plant and distribution system. John N. Johnson is interested in the company.

THE CITIZENS' ELECTRIC & SERVICE COMPANY, Monticello, Ky., has been incorporated with a capital stock of $100,000 by Reuben W. Wright, Herbert J. Hodgkins and Chester C. Doty.

THE DEN-HART MANUFACTURING COMPANY, New Haven, Conn., has been incorporated by E. W. E. Denis, William R. Hartley and E. C. Smythe, 54 Tilton Street. The company is capitalized at $50,000 and proposes to manufacture electrically operated washing machines.

THE RISLER-HORNUNG CORPORATION, New York, N. Y., has been incorporated by E. A. Risler, Jr., H. J. Hornung and R. W. Maloney, 305 Broadway. The company is capitalized at $18,000 and proposes to manufacture electrical supplies.

THE ELECTRIC MANUFACTURING & SALES COMPANY, Newark, N. J., has been incorporated by E. and Abraham Beller and Herbert Parvin, 128 Market Street. The company is capitalized with a capital of $100,000 and proposes to manufacture electrical products.

ROBERT S. CONLON, INC., New York, N. Y., has been incorporated with a capital stock of $10,000 and proposes to manufacture electrical equipment. The incorporators are R. S. Conlon, W. F. Davis and E. A. Vosseler, 149 Broadway.

THE ROXBURY (N. Y.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $20,000 by J. H. Dart and others.

Record of Electrical Patents

Notes on United States Patents

(Issued April 26, 1921)

1,375,712. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed March 25, 1918. Manual and automatic exchange.

1,375,728. DISTRIBUTING APPARATUS; Paul M. Rainey, Glen Ridge, N. J. App. filed Aug. 28, 1917. Multiplex printing telegraph.

1,375,739. VACUUM-TUBE APPARATUS; Edward O. Scriven, New York, N. Y. App. filed June 27, 1918. Grid at potential different from that of filament.

1,375,740. SEPARATOR FOR STORAGE BATTERIES; Walter M. Studebaker and Herbert J. Epple, Erie, Pa. App. filed July 17, 1920. Woven glass.

1,375,741. PROCESS OF AND APPARATUS FOR PROGRESSIVE ELECTROSTATIC SEPARATION OF COMMINUTED MATERIAL; Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. App. filed Aug. 9, 1914.

1,375,745. ARMATURE-WINDING MACHINE; Leonard E. Wood, Valleyfield, Quebec, Canada. App. filed Sept. 30, 1918. Entirely automatic.

1,375,762. DISTRIBUTING SWITCH; George Thompson, Mount Vernon, N. Y. App. filed May 10, 1919. Automatic telephone.

1,375,763. METHOD OF FORMING STORAGE-BATTERY SEPARATORS; Theodore A. Willard, Cleveland, Ohio. App. filed Feb. 26, 1915.

1,375,765. TRANSFORMER SECONDARY CONNECTION FOR ELECTRIC METAL-WORKING APPARATUS; Herbert A. Woofter, Swampscott, Mass. App. filed July 30, 1920. Welding machine.

1,375,801. ELECTRIC COOKING STOVE; Allen R. Ross, Seattle, Wash. App. filed July 1, 1919.

1,375,819. PROCESS AND APPARATUS FOR THE ELECTROLYTIC GENERATION OF ARSIN, PHOSPHIN AND STIBIN; Henry Blumenberg, Jr., Oro Grande, Cal. App. filed June 11, 1919.

1,375,837. ELECTRICAL MEASURING INSTRUMENT; Charles E. Foster, Letchworth, England. App. filed Sept. 11, 1916. Spring-mounted jewel bearings.

1,375,863. ELECTRICAL APPLIANCE; John T. Stanton, Seattle, Wash. App. filed June 1, 1920. Electro-therapeutic blanket.

1,375,879. BRUSH AND METHOD OF MANUFACTURING THE SAME; Hugh H. Wikle, Chicago, Ill. App. filed April 13, 1918. For electrical machinery.

1,375,884. ELECTRIC IGNITION APPARATUS; Frank Aiken, Elkins Park, Pa. App. filed June 20, 1919. Internal-combustion engine.

1,375,974. INSULATOR CONNECTOR; Henry T. Pierce and Angus D. McPhee, Worcester, Mass. App. filed Feb. 11, 1918. For Hewlett type.

1,375,981. PROTECTIVE DEVICE; Benjamin H. Thompson, Schenectady, N. Y. App. filed Aug. 28, 1919. Overload relay of retarded type.

1,375,982. CONDENSER; Elihu Thomson, Lynn, Mass. App. filed Nov. 16, 1916. For use with high-potential electrical distribution systems.

1,375,991. SYSTEM OF ELECTRICAL DISTRIBUTION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 6, 1917. High frequency.

1,375,996. METHOD OF AND APPARATUS FOR PREVENTING INJURY OF SEARCHLIGHT MIRRORS; Heinrich Beck, Schenectady, N. Y. App. filed June 12, 1920. Electrically heated at cool spot.

1,376,011. ELECTRIC APPARATUS; John J. Frank, Pittsfield, Mass. App. filed April 25, 1919. High-current winding, having taps.

1,376,015. ELECTRICAL REGENERATIVE CONTROL APPARATUS AND SYSTEM; William S. H. Hamilton, Schenectady, N. Y. App. filed March 3, 1919. Variable-pole induction-type machines.

1,376,020. BRUSH-SHIFTING DEVICE FOR ALTERNATING-CURRENT MOTORS; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed Feb. 13, 1918.

1,376,022. SPARK-TROUBLE LOCATOR; Samuel P. Langmaid and Leonard A. Walton, Seattle, Wash. App. filed Sept. 1, 1920. Secured to dash of automobiles.

1,376,023. ELECTRIC HEATING DEVICE; Milton E. Long and George W. Katzung, Pittsfield, Mass. App. filed April 2, 1917. Turner for toaster.

1,376,024. AUTOMATIC PAWL THROW FOR MAGNETOS OR THE LIKE; Phillip E. Matthews, Plainfield, N. J. App. filed July 3, 1919.

1,376,034. MEANS FOR PROTECTING BATTERY ANODES; Herbert R. Palmer, Cleveland Heights, Ohio. App. filed Nov. 28, 1919. To prolong indefinitely the "shelf life."

1,376,041. BRUSH HOLDER; Henry K. Sandell, Chicago, Ill. App. filed June 12, 1916. Means for supporting.

1,376,051. SIMULTANEONS TRANSMISSION OR RECEPTION OF SPEECH AND SIGNALS; Albert H. Taylor, Grand Forks, N. D. App. filed April 10, 1919. Radio transmitting and receiving.

1,376,052. CYLINDER FOR ELECTROPLATING APPARATUS AND THE LIKE; Floyd T. Taylor and Wesley F. Hall, Matawan, N. J. App. filed May 13, 1918. Positive circulation of liquid.

1,376,066. CONDUCTOR-GRIPPING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed May 2, 1916. Cord grip.

1,376,068. COMBINATION CAP AND SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed June 7, 1919. Cap and socket separate when cord is pulled.

1,376,072. ELECTRIC FURNACE; William K. Booth and William L. Morris, Chicago, Ill. App. filed April 9, 1920. Oscillating or rotary.

1,376,080. HIGH-FREQUENCY MACHINE; Charles W. De Moov, Cleveland, Ohio. App. filed Aug. 20, 1917. Therapeutical.

1,376,081. HIGH-FREQUENCY GENERATOR OF THE TRANSFORMER TYPE; Charles W. De Mooy, Cleveland, Ohio. App. filed Aug. 20, 1917. No vibrator.

1,376,143. STORAGE-BATTERY TERMINAL; Clarence W. Hazelett, Lakewood, Ohio. App. filed Nov. 3, 1916. Connector with brass screw embedded in lead.

1,376,144. STORAGE-BATTERY TERMINAL POST; Clarence W. Hazelett, Lakewood Ohio. App. filed Sept. 21, 1917. Completely embedded copper rod.

1,376,154. ELECTRICAL LIGHTING DEVICE FOR CIGARS AND THE LIKE; Joshua M. Morris, Rochester, N. Y. App. filed Oct. 2, 1919.

1,376,162. MAGNETO CONTACT; Virgil Rigsby, Hemphill, Tex. App. filed March 9, 1920. For Ford magneto.

1,376,171. STORAGE BATTERY; Malcom O. Smith, Indianapolis, Ind. App. filed June 9, 1919. Terminal posts readily removed.

1,376,185. ELECTRODE HOLDER; William R. Beazley, Jacksonville, Fla. App. filed July 21, 1920. For removing connector straps of battery by electric current, avoiding drilling.

1,376,207. PROCESS FOR THE PRODUCTION OF COMPOUNDS BY GAS REACTIONS AND APPARATUS THEREFOR; Charles B. Jacobs, Wilmington, Del. App. filed Sept. 27, 1919. Production of nitrogen compounds.

1,376,208. ELECTRIC COOKING RANGE; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918.

1,376,209. ELECTRICAL HEATING UNIT; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 25, 1919. For immersion in liquids.

1,376,243. SAFETY LAMP; Nicholas Albert, Longmont, Col. App. filed Sept. 8, 1920. Lamp is extinguished when globe is broken.

1,376,257. STORAGE BATTERY; Thomas R. Cook, East Cleveland, Ohio. App. filed May 11, 1918. Cooled by continuous circulation of electrolyte.

1,276,288. ELECTRICAL SYSTEM FOR PRODUCING MUSICAL TONES; Frank E. Miller, New York, N. Y. App. filed March 18, 1915. By exciting an audion in response to electric pulsations.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WINTHROP, ME.—C. M. Bailey & Company plan to rebuild their oilcloth manufacturing plant, recently destroyed by fire, causing a loss of $150,000, including equipment. New power-plant equipment and other machinery will be required.

WATERBURY, CONN.—The Connecticut Light & Power Company has arranged for an issue of $6,500,000 in bonds, part of the proceeds to be used for additions to electric generating plants. Irvin W. Day is vice-president.

Middle Atlantic States

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Albany, until June 1 for building addition to power house at the Central Islip State Hospital. E. S. Elwood is secretary. L. F. Pilcher is state architect.

ELLENVILLE, N. Y.—The Ellenville Electric Company has filed notice of increase in capital stock from $30,000 to $60,000.

UTICA, N. Y.—The Madison Power Company, recently incorporated with a capital of $200,000, plans to erect an electric power plant for service in Madison and Oneida Counties. Dunmore, Farris & Dewey represent the company.

UTICA, N. Y.—The Utica Motor Car Company, Kent Avenue, plans to build an automobile service and repair building to cost about $250,000. Considerable electrical and mechanical equipment will be required.

WATERTOWN, N. Y.—The City Council is considering calling an election to submit to the voters the proposal to issue $385,000 in bonds for the completion of the city's power development.

CATASAUQUA, PA.—The Pennsylvania Power & Light Company will make new installations to replace existing pole lines, transformers and other equipment in this section.

COATESVILLE, PA.—The Town Council has approved an ordinance providing for the installation of an ornamental lighting system on Lincoln Highway. Cluster lamps on standards will be used.

FELTON, PA.—Negotiations are under way between the Town Council and the Edison Light Company, York, for the extension of the latter's lines from Red Lion to Felton. The present plans provide for the construction of a power plant on Muddy Creek.

PHILADELPHIA, PA.—Arrangements have been made by the Philadelphia Electric Company for an issue of $5,000,000 in stock, part of the proceeds to be used for extensions, etc. Joseph B. McCall is president.

SHARPSBURG, PA.—Arrangements have been made for an issue of $130,000 in bonds for municipal improvements, a considerable portion of the proceeds to be used for extensions and improvements to the local light and power system.

RIVERDALE, MD.—The construction of a municipal lighting plant to supply electricity to Berwyn and Bowie has been authorized by the voters.

PETERSBURG, W. VA.—The Community Power Company, recently organized, plans to erect a transmission line to Moorefield, a distance of about 12 miles. R. W. Baker is manager.

NEWPORT NEWS, VA.—The Newport News & Hampton Railway, Gas & Electric Company has filed notice of $1,000,000 increase in capital stock, the proceeds to be used for extensions. J. N. Shannahan is president.

PULASKI, VA.—The Virginia Anthracite Coal Corporation is considering the installa-

tion of electrical and other machinery at its properties. John G. Hayes is construction engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 18 for the installation of a turbo-generator and switchboard at Bellevue. Specification 4317.

WASHINGTON, D. C.—Bids will be received at the office of the chief of engineers, U. S. A., until May 31, Advertisement No. 69, for 2,200 ft. cable, type RL, one conductor; two reels for above; 1,500 ft. cable, type RL, on conductor; two reels for above; 1,540 ft. three-conductor cable, and one reel.

WASHINGTON, D. C.—An act appropriating $619,250 for fortifications and other works of defense for the Panama Canal Zone for year ending June, 1922, has been passed by Congress, which includes maintenance and repair of searchlights, electric light and power equipment, tools, electrical and other supplies and appliances, $30,000; purchase and installation of searchlights, $6,250; continuing construction of barracks, quarters, storehouses and other buildings necessary for accommodating the Coast Artillery troops to be stationed in the vicinity of the Panama Canal, including water, sewer and electrical systems, roads, walks, etc., $100,000.

North Central States

ASSYRIA, MICH.—The question if issuing $25,000 of electric light bonds is under consideration.

DETROIT, MICH.—The Council has authorized an appropriation of $50,000 for preparation of plans for a new municipal lighting plant. James Couzens is Mayor.

DETROIT, MICH.—The Timken-Detroit Axle Company, Clark Avenue, plans to erect a new one-story turbine power house to cost about $35,000. H. W. Alden is secretary.

MARCELLUS, MICH.—The question of issuing $15,000 in bonds for the purchase of a steam engine, generator and exciter, and a switchboard panel with equipment for same, for a new electric light plant and water-works is under consideration.

NILES, MICH.—The French Paper Company plans to build a new power plant this summer.

NORTHVILLE, MICH.—The local plant of the Detroit Edison Company was damaged by lightning recently, causing a loss of about $25,000.

FALMOUTH, KY.—Plans are being prepared for the erection of an electric power plant and pumping station at the municipal water-works. Glazier & Morlidge, 20 Miller Building, Cincinnati, Ohio, are engineers.

KENTLAND, IND.—The installation of a municipal electric light plant is under consideration. Ora E. Sellers is trustee.

ATHENS, ILL.—Bonds to the amount of $25,000 have been voted for the erection of an electric light plant between the water-works near Springfield and Athens.

CENTRALIA, ILL.—The City Council is considering the installation of an ornamental lighting system.

FREEPORT, ILL.—A movement has been started by property owners on Lincoln Boulevard to have an ornamental lighting system installed on that thoroughfare.

MANITOWOC, WIS.—The installation of an ornamental lighting system on parts of Eighth and Washington Streets to cost about $10,000 is under consideration.

MILWAUKEE, WIS.—The North East Power Company, a subsidiary of the Wisconsin Public Service Company, 425 East Water Street, has applied to the State Railroad Commission for permission to proceed with a hydro-electric power plant project on the Peshtigo River, near Ellis Junction. Two sites are to be developed by the construction of concrete dams, reservoirs and generating plants. Mead & Seastone, consulting engineers, Madison, are in charge of the project.

NEW HOLSTEIN, WIS.—Bids will be received until May 30 by H. N. Edens, chairman of the lighting commission, for the erection of a 66,000-volt transmission line to connect with the line of the Calumet Service Company at the city limits of Chilton. The cost of the work is estimated at $50,000.

OCONTO FALLS, WIS.—Arrangements are being made for an issue of $50,000 in bonds for electric light improvements and water-works extensions.

WAUKESHA, WIS.—Plans are being prepared by Erol X. Smith, architect and engineer, 305 East Fifty-fifth Street, Chicago, Ill., for a boiler house and power plant, in connection with a hospital to be built in Waukesha for Dr. I. J. Frisch.

PRESTON, IOWA.—J. T. Marron has purchased the Rural Power Company plant at Preston and plans to erect a high-tension transmission line from Clinton to serve Preston, Goose Lake, Miles, Sherlock, Bryan and Sprague ville. It is also planned to furnish electricity to farmers in the vicinity of these places.

SIOUX CITY, IOWA.—The installation of more than 200 street lamps in the city this year has been recommended by J. B. Mann, head of the Public Safety Department.

BERESFORD, S. D.—Steps have been taken to make municipal improvements for which $70,000 in bonds have been authorized, and which include a new engine for the electric light plant and sinking an additional well for the waterworks system.

BROOKINGS, S. D.—Bonds to the amount of $60,000 have been voted for remodeling, enlarging and repairing the municipal light and power plant.

TECUMSEH, NEB.—Bonds to the amount of $4,000 have been voted in Elm Creek for the erection of an electric transmission line from Tecumseh municipal electric plant to Elm Creek.

LAWRENCE, KAN.—The State Commission, Topeka, is having plans prepared for the erection of a new two-story electric power plant, 75 x 118 ft., at Kansas University, Lawrence, to cost with machinery about $300,000. J. M. Shea, Kansas University, is engineer.

Southern States

GEORGETOWN, S. C.—The city has purchased the lighting plant of the Georgetown Railway & Light Company and plans to operate same in connection with the municipal waterworks. Improvements, it is understood, will be made.

LAURENS, S. C.—A proposal to issue $65,000 in bonds for extension to lighting system, street improvements and sewer extensions will be submitted to the voters.

LEESBURG, FLA.—Two proposals for extensions to the municipal lighting system will be submitted to the voters: (a) to issue $75,000 in bonds for enlarging power plant; (b) $40,000 for erection of transmission line to Iverness to secure electricity from the plant of Camp Brothers, Ocala. The project includes the erection of 24 miles of high-tension line. W. A. McKenzie is Mayor.

GEORGETOWN, TEX.—New equipment, including an electric generating unit, will be installed in the municipal water and light plant.

Pacific and Mountain States

OKANOGAN, WASH. — The Okanogan Valley Power Company has announced that about twenty electrically operated pumping plant will be installed in this locality for irrigation purposes.

SEATTLE, WASH. — A resolution has been introduced in the City Council and referred to the city utilities committee providing for the installation of cluster lamps on University Way from East Fortieth Street to East Forty-seventh Street.

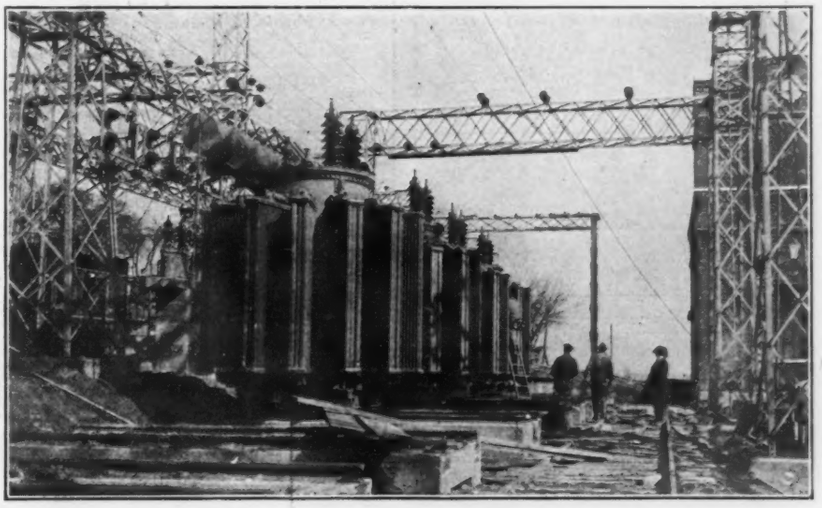
BALDWIN LAKE, CAL.—The Southern Sierras Power Company, Riverside, has closed a contract for the erection of a 3,000-volt transmission line from the Apple Valley line at Tussigs to the mining property at Gold Mountain, near Baldwin Lake, a distance of 25 miles.

BERKELEY, CAL.—The Board of Education has decided to ask for bids for excavation and concrete work on the new power plant at the high school. W. C. Hays is supervising architect.

PASADENA, CAL.—The Southern California Edison Company has a budget appropriation of $126,589 for new construction and system expenditures in the Pasadena district. The plans provide for a 15,000-volt transmission line from the company's main receiving station at Eagle Rock to the substation at Altadena. A similar line is to be erected from Sunland to the San Fernando station, connecting with the Kern River system, where the Kern River power plant No. 3 is nearly completed.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company is considering extensions and improvements to its electric power plants and system to cost about $520,000.

LOVELAND, COL.—Bonds to the amount of $45,000 have been voted to enlarge the municipal electric plant.



DROVOSBURG SUBSTATION OF DUQUESNE LIGHT COMPANY, PITTSBURGH, SHOWING FOUR OF THE 4,167-KVA., SINGLE-PHASE TRANSFORMERS BEING INSTALLED BY DWIGHT P. ROBINSON & COMPANY, ENGINEERS

Canada

ST. JOHN, N. B.—The New Brunswick Electric Power Commission is considering furnishing electricity in a number of towns in Maine, including Centreville, Florenceville, Hartland, Bristol and Bath. It is proposed to purchase energy from the Maine & New Brunswick Power Company, Presque Isle, Me., and erect a transmission line probably from Bridgewater to Florenceville and on along the St. John River.

THURO, N. S.—The Common Council is considering the purchase of electrical equipment to cost $23,000.

QUEENSTON, ONT.—One of the 55,000-hp. generators at the Queenston power house of the Queenston-Chippawa development was recently damaged by fire, causing a loss of about $50,000.

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